

CERJAC SERIES 31XE

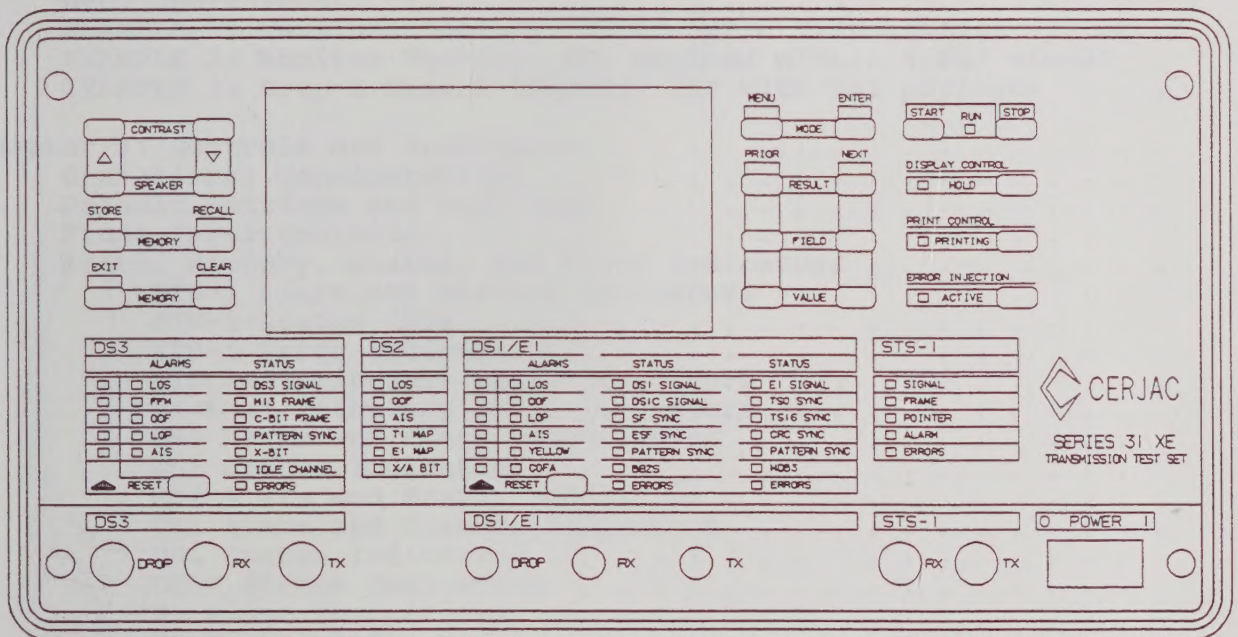
Transmission Test Set

User's Manual

Version 1.0

Series 31XE Transmission Test Set

User's Manual V1.0



CERJAC Inc. 43 Nagog Park, Acton MA 01720



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Table of Contents

Chapter 1: Introduction	1
Unpacking The Series 31XE	1
About This Manual	1
Modularity of the Series 31XE	2
Software Upgrades	3
System Overview	3
Applications	4
Development	4
Manufacturing	5
Qualification and Installation	5
Maintenance	6
Chapter 2: Quick Start	7
Menu Operations	7
EXAMPLE 1: Terminal Testing, Fiber-Optic Transmission System	8
EXAMPLE 2: Monitor Testing, DS1 payload within a DS3 signal	10
EXAMPLE 3: Drop & Insert Testing, DS3 with DS1 payloads	13
Chapter 3: Controls and Indicators	16
Operational Considerations	16
Default Settings and Cold Start	16
Front Panel Controls	17
Alarm, History, Status, and Error Indicators	19
STS-1 Alarm and History Indicators	20
STS-1 Status LEDs	21
STS-1 Error Indicator	22
Virtual Tributary Alarm Indicators	22
Virtual Tributary Error Indicators	22
DS3 Alarm and History Indicators	22
DS3 Status Indicators	23
DS2 Alarm and Status Indicators	24
DS1 Alarm and History Indicators	25
DS1 Status Indicators	26
DS1C Status Indicators	26
E1 Alarm Indications	26
E1 Status Indications	27
Front Panel Connectors	27
Rear Panel Signal Connectors	28
Chapter 4: Testing with the Series 31XE	30
MAIN MENU SELECTION: Terminal	30
MAIN MENU SELECTION: Monitor	34
MAIN MENU SELECTION: D&I	37
Configuration Values	40
STS-1 Test Configurations	40
STS-1 Error Injection	41
VT1.5 Test Configurations	42
VT Group Test Configurations	43
VT1.5 Error Injection	43
DS3 Test Configurations	44
DS3 and DS2 Error Injection	46

DS1 Test Configurations	48
DS1 Error/Alarm Injection	52
DS0 Test Configurations	53
E1 Test Configurations	53
E1 Error/Alarm Injection	55
E1 Timeslot Test Configurations	57
Alternate Configuration Screens	58
Global Configurations Screen	58
SONET Alarm Screen	60
K1,K2 APS Screen	61
MAIN MENU SELECTION: Sequences	64
DS1 Drop Scan Sequence	64
Chapter 5: Using Special Features	66
MAIN MENU SELECTION: Patterns	66
STS1 Transport Overhead Configuration	67
STS-1 Path Overhead Configuration	68
Path Trace Bytes 1 - 32, and 33 - 64	68
DS1 Data Patterns	70
DS3 Data Pattern & DS1 Loop Codes	70
MAIN MENU SELECTION: Setup	71
Global Test Setups	71
Administrative Setups	74
Event Logging Setups	75
MAIN MENU SELECTION: Configure	76
Chapter 6: Measurements	79
Results Screens	79
STS-1 Measurements	79
Section Code Violations (B1)	79
Line Code Violations (B2)	80
STS Frame Measurements (A1/A2)	81
STS-1 Signal Measurements	81
STS-1 BPV Measurements	81
Path Code Violations (B3)	82
Path FEBE Measurements	83
STS-1 Pointer Measurements	83
APS (K1/K2) Measurements	84
STS-1 Transport Overhead	86
STS-1 Path Overhead	86
STS-1 Path Trace Byte (J1)	87
STS Alarm Seconds	87
STS Alarm Hist	88
STS Status	88
VT1.5 Measurements	88
VT1.5 Code Violations (V5)	88
VT1.5 FEBE Measurements	89
VT1.5 Pointer Measurements	89
VT1.5 Alarm	90
VT1.5 Alarm Seconds	90

DS3 Measurements	90
DS3 Signal Measurements	90
DS3 Bit Error Measurements	91
DS3 BPV Measurements	92
DS3 Section Parity Measurements (P-Bit)	93
DS3 Path Parity Measurements (CP-Bit)	94
DS3 Frame Measurements	94
DS3 FFCV Measurements	95
DS3 Alarm and Status Seconds	96
DS3 Alarm Hist	96
DS3 Status	96
DS2 Alarms and Status	96
DS1 Measurements	96
DS1 Signal Measurements	96
DS1 CRC-6 Error Measurements	99
DS1 Frame Error Measurements	99
DS1 Combined Frame & CRC Errors	100
DS1 BPV Measurements	100
DS1 Slips	101
DS1 Alarm Seconds	102
DS1 Alarm & Hist	102
DS1 Status	102
DS0 Measurements	102
E1 Measurements (Rx)	103
E1 Signal Measurements	103
E1 Bit Error Measurements	103
E1 TS0 Frame Error Measurements	105
E1 CAS Frame Error Measurements	105
E1 CRC-4 Error Measurements	106
E1 BPV Measurements	106
E1 Slips	107
E1 Alarm Seconds	108
E1 Alarm & Hist	108
E1 Status	108
E1 Time Slot Measurements	108
Chapter 7: Specifications	110
STS-1 Interfaces	110
Front-Panel STS-1 Transmitter Specifications	110
Front-Panel STS-1 Receiver Specifications	110
DS3 Interfaces	111
Front-Panel DS3 Transmitter Specifications	111
Front-Panel DS3 Drop Specifications	111
Front-Panel DS3 Receiver Specifications	112
DS1 Interfaces	112
Front-Panel DS1 Transmitter Specifications	112
Front-Panel DS1 Drop Specifications	112
DS1 Receiver Specifications	113
Rear-Panel DS1 Network Interface Port	113
E1 Interfaces	113
Front-Panel E1 Transmitter Specifications	113
Front-Panel E1 Drop Specifications	114
E1 Receiver Specifications	114

DS0 and E1 Timeslot Interfaces	114
VF Input and Output	114
DS0 Drop & Data Link Port	114
Signaling Output Port	115
Control Interfaces	115
Burst Error In Specifications	115
DS3 and DS1 Bit Error Outputs	115
Printer Output Specifications	115
Remote Control Port Specifications	116
IEEE-488 Port Specifications	117
Timing and Synchronization	117
STS-1 Timing	117
DS3 Timing	117
DS1 Timing	118
E1 Timing	118
Power	118
Environmental	118
Mechanical	118
Chapter 8: Options	119
Remote Front Panel Option	119
IEEE-488 / Command Line Interface	119
Data/Event Logging Option	119
Answer-Only Modem	120
Rack Mount Kit	120
APPENDIX A: Software Download Procedure	121
Overview	121
Quick Procedure	121
Using a Different COM Port or Baud Rate	122
Specialized Applications	122
Distribution Diskette	123
Appendix B: Warranty and Service	124
Warranty	124
In case of Technical Difficulty	124

Chapter 1: Introduction

Congratulations on your purchase of the Series 31XE Transmission Test Set. As you begin to use the Series 31XE and this manual, please keep in mind that CERJAC is always interested in your comments or questions regarding features, operation, or applications. Your comments will help us to keep the Series 31XE at the forefront of the telecom transmission testing field, and will enable us to continue to satisfy your T-Carrier and SONET testing requirements. You can contact CERJAC Customer Support at (508) 263-2004.

Please take a few moments to read this chapter. It will help you to better use the Series 31XE. This chapter discusses the organization of the rest of the manual and provides some important information that you should understand before you use the Series 31XE.

Unpacking The Series 31XE

We have taken precautions to insure that your instrument arrives safely and undamaged, but ask that you inspect the packing material for signs of visible damage that may have occurred in shipment. If you suspect that your unit has been damaged, please contact your freight carrier for information about filing a damage claim and then contact CERJAC at (508) 263-2004. When unpacking your instrument, please be sure to save the packing materials for future shipment. The Series 31XE is operational when removed from its shipping container and requires no special preparation. Please check to be sure that you have received the following accessories:

1. This Manual
2. Line Cord

About This Manual

This manual contains eight chapters and is designed to help you understand the Series 31XE, its uses, functions and operations. The manual covers all rates and payloads available for the Series 31XE. (See Modularity, below.) This makes the manual useful for users of fully-configured Series 31XE Test Sets, and provides detailed information on available upgrades for users of partially configured systems.

Depending upon your specific requirements, you may choose to read individual chapters of the manual or the entire document. The detailed table of contents is organized to allow easy searching for specific information. In each chapter information is grouped according to test rates or features, enabling quick reference.

Chapter 1 provides general introductory information about the Series 31XE and its applications.

Chapter 2, entitled Quick Start, presents step-by-step instructions for example tests using pre-programmed test setups. This allows users to quickly get the Series 31XE into operation without the need to read the entire manual. The features described in the Quick Start chapter are a small subset of the Series 31XE capability, but give the user a feel for the instrument.

Chapter 3 introduces the controls and front panel indicators of the Series 31XE, as well as presenting fundamental information about operation.

Chapter 4 provides a description of testing with the Series 31XE. Selectable test parameters are presented and defined.

Chapter 5 presents special features of the Series 31XE, such as overhead programming, automatic test sequences, test configuration storage, and more. Chapters 4 and 5 together present the entire menu-oriented user interface.

Chapter 6 provides technical definitions of the measurements made by the Series 31XE.

Chapter 7 contains interface and mechanical specifications for the Series 31XE.

Chapter 8 provides an overview of options currently available for the Series 31XE.

Appendices contain information about warranty and technical support. There is also a procedure for field download of new software revisions.

Modularity of the Series 31XE

The Series 31XE is based on a modular hardware and software architecture which allows configuration of the unit to meet each user's requirements. The base configuration of the Series 31XE provides full DS3 testing capability with the ability to upgrade for DS0, E1, DS1, and SONET STS-1 testing.

Software Upgrades

Upgrades to the operating software for the Series 31XE will continue to be available in accordance with the needs of evolving standards and test applications. New versions of the operating software affect the modes, options, choices and other operational parameters and characteristics of the Series 31XE. The ability to upgrade instrument features and performance with software updates maintains the instrument's effectiveness for future use.

System Overview

Separate transmitter and receiver sections are used to interface with DS1, E1, DS3, and STS-1 signals. Specifications for each of the transmitters and receivers can be found in Chapter 7. The transmitters and receivers are dynamically configured, to combine or extract (Drop or Insert) various signals as required by each specific test. In addition to conventional transmission sources, error insertion is also used to introduce a variety of errors for diagnostic purposes.

A signal analysis function is used to monitor and evaluate signals present on the various receivers. This analysis function is used to generate detailed test results on the screen display and to drive alarm and history lamps on the front panel.

Finally, a set of 12 buffers under user control extracts and stores test results for actual tests that can be recalled at a later time for review and analysis.

There are also 10 configuration storage buffers that, under user control, store the selection of test modes, patterns, signals and related configuration information for later retrieval. This permits users to custom configure the Series 31XE and save the configurations for testing at a later time.

Central to an understanding of the functionality of the Series 31XE is the control section. The control section dynamically configures the functions and options to create the variety of modes available to the user. Operating software can be changed and updated as standards and implementations change.

Interaction with the user is through a menu-oriented screen display and generalized pushbuttons that are used to select and display menu options.

Applications

The Series 31XE Test Set has diverse applications ranging from design and manufacture of transmission equipment to network test and maintenance. The unit provides the ability to passively monitor communications and signals or to generate patterns and alarm conditions that can be used to test terminal equipment and installations for proper operation.

A remote front panel option uses a terminal or PC to take advantage of the instrument's capability from a remote site. Internal memory captures and retains setup information, test results and alarm conditions for examination on the fly or for detailed analysis after data has been recorded or a test has been completed.

Because of the versatility and programmability of the Series 31XE, it can be used by both experienced and casual users alike.

The Series 31XE Transmission Test Set is designed for equipment qualification, installation and on-going high maintenance activities. It is an effective tool for service providers when checking network equipment both in and out of service. It is also useful as a diagnostic tool for design and manufacturing of transmission equipment. The flexibility in selecting rates and payload structures makes the Series 31XE particularly useful for testing of multiplexers, cross-connect devices and other transmission systems with DS1, E1, DS3, or STS-1 interfaces.

Development

At the development stage, the Series 31XE is an ideal tool for a variety of signal monitor, signal test and signal generation functions. It is extremely useful for performance testing of transmission and multiplex products in the alpha-test or qualification stages of design.

Development engineers can use the Series 31XE to create test and diagnostic patterns for new equipment. The data logging capability of the instrument is ideal for overnight qualification testing. Optional remote operation allows the Series 31XE to be physically located anywhere in a development installation. Users can remotely program and control operation of the instrument whenever needed.

Since program settings and logged data are stored by internal battery backup memory, the Series 31XE can be moved to different locations in a development lab for extensive testing with no loss of data or test setup information.

Manufacturing

In manufacturing and production, the Series 31XE integrates fully with automated test systems through an extensive IEEE-488 instrument control option featuring the SCPI control language. SCPI (Standard Commands for Programmable Instruments) provides a common programming syntax for equipment from different vendors. This means that automated test programmers can integrate new instruments more quickly than in the past, without learning a new language format for each test set. Please see the Series 31XE IEEE-488 Programming Guide for further information.

For production test, the Series 31XE can be programmed to simulate a variety of transmission and alarm conditions. In the Terminal Mode, it can be programmed to create a variety of signal and payload combinations. Either internal or external data can be used to create payloads. Printout of individual test results is a standard feature useful for quality control record keeping.

Monitor Mode testing is also useful for production environments which use separate digital sources such as CERJAC's model 4552 for simultaneous generation of multiple test signals.

Qualification and Installation

Before putting a new piece of equipment or a modified installation into service, the Series 31XE can be used in the Terminal and Drop & Insert modes to test installation integrity. The Series 31XE generates a variety of signals and payloads to test an installation's ability to pass, multiplex or demultiplex signals, subchannels and payloads. Testing can be done at DS0 through STS-1 levels. Generated signals can include programmable patterns, VT1.5 or M13 mappings of internal or external DS1 signals, or DS3 and channels, as required. The Series 31XE has the ability to add or drop signals to or from payloads to test the viability of multiplex and demultiplex equipment.

As a diagnostic tool, either for qualification or installation testing, the Series 31XE gives service providers the ability to program and observe a wide range of error and alarm conditions that typically occur in installations. Detected alarm and error information is presented in both visual and audible formats. In addition, STS-1 pointer movement can be observed. Excessive adjustment of the pointer can indicate network synchronization or system problems.

Maintenance

It is often necessary to provide external monitoring capability for extended testing of circuits with intermittent errors or failure conditions. The Series 31XE provides an automatic data logging function where up to twelve complete sets of test results can be recorded and stored for use. The stored data and the programmed logging functions are retained even in the event of power loss.

In addition, the Data/Event Logging option allows capture of alarm events and user-specified error conditions. Date and time stamped event messages are logged to internal memory or to an attached printer. For long term or remote monitoring, the Series 31XE can be left as a permanent part of an equipment installation with reports gathered manually or automatically.

Maintenance functions also involve recovery from network equipment failures. The signal generation and analysis capabilities of the Series 31XE can take the guess-work out of these highly critical repair tasks.

Because the Series 31XE retains its program and stored data during power interruption, it can be set up and used with minimal experience or knowledge of the instrument. Operating personnel need only connect and power up the instrument. Sophisticated testing can thus be performed automatically without requiring detailed test set knowledge.

Chapter 2: Quick Start

This chapter is provided for users who do not want to read the entire manual at this time. The chapter provides a brief introduction to menu operations, then presents three step-by-step examples: one example for Terminal Testing, one example of a Drop & Insert test, and one Monitor Testing example.

This chapter does not give the user a complete understanding of the many features and options of the Series 31XE nor does it describe the range of data collection and data analysis performed by the instrument. Rather, it describes default values, default settings and the fundamental modes of operation.

Menu Operations

When using the Series 31XE, interaction between the user and the instrument is through a set of menu display selections that appear on the alphanumeric screen. These menus provide choices available for each of the primary modes. Selections are chosen by the user through the use of the MENU, ENTER, FIELD, VALUE and RESULTS pushbuttons.

The user is able to select a test category from the opening screen and then step deeper into the criteria and options available for that particular test.

ENTER is used to step from one selection category to another or from a selection category to live testing displays.

MENU is used to step backwards through the selections made with the ENTER button.

FIELD pushbuttons are used to cycle forward or backward through the results fields shown on the screen. The nature and number of fields shown is dependent upon the menu that has been selected.

VALUE pushbuttons are used to cycle forward or backward through the different values for operating parameters for the field that has been selected in the previous step.

RESULTS for each of the testing modes are sequentially displayed in the upper half of the display screen each time these pushbuttons are depressed. Depending on the

mode of operation, there are one or more screens that display results.

The START and STOP pushbuttons are used to begin and suspend testing.

LED indicators described in Chapter 3 will illuminate to indicate status, alarms, and alarm history.

Test results are displayed on a series of results screens. The information as well as the number of results screens is dependent upon the testing mode and associated selections. Results screens are divided into various fields and are labeled. These results screens can be directed to a printer, if desired, by pressing the PRINT pushbutton.

EXAMPLE 1: Terminal Testing, Fiber-Optic Transmission System

As shown in Figure 2.1, this example tests an asynchronous fiber-optic transmission system transporting DS3 payloads. The DS3 transmit and receive interfaces of the test set are connected to the fiber-optic terminal. The DS3 at the far-end terminal is looped back.

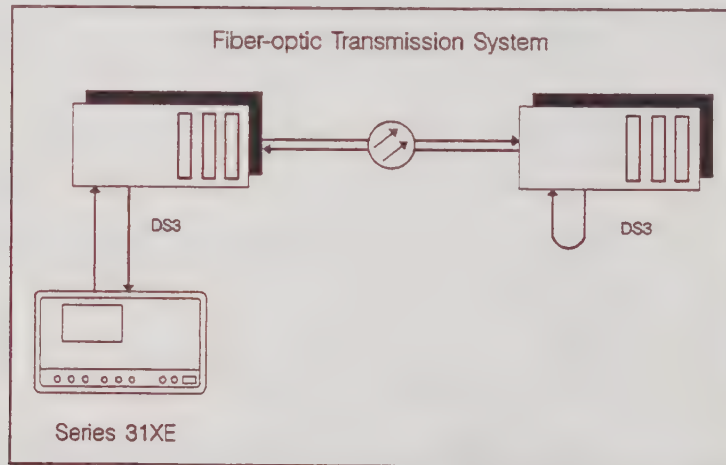


Figure 2.1: End to End DS3 Testing

To perform the testing, "Terminal" is selected from the opening Main Menu screen. When the instrument is first powered up, the Main Menu will be visible as shown below. If the Main Menu is not visible, pressing the MENU button once or twice will bring the Main Menu to the screen.

MAIN MENU

Terminal (Independent Tx and Rx)
Monitor (Non-disruptive pass-through)
D&I (Payload Drop & Insert)
Sequences (Programmed test sequences)
Patterns (Programmable data patterns)
Setup (System parameters)
Configure (Store/Recall configurations)

Press PREV FIELD/NEXT FIELD to select.
Press ENTER for next level of selection.

"Terminal (Independent Tx and Rx)" should be highlighted. If it is not, the Field pushbuttons can be depressed (multiple times, if necessary) to scroll forward or backwards through the Main Menu to select Terminal Testing. Once it is highlighted, the Enter pushbutton is pressed to select the choice.

At this point, the user chooses the transmit and receive rates as well as the payload as shown below.

TERMINAL TESTING

Tx Rate: DS3 Rx Rate: DS3

Payload: DS3

Select Tx and Rx first
then select payload.

Press ENTER to enter test mode.
Press MENU to return to Main Menu.

The values of DS3 for Tx Rate, DS3 for Rx Rate and DS3 for Payload should be selected. If these values are not displayed, the user should step to the appropriate field (Tx Rate, Rx Rate, Payload) with the Field pushbutton and then scroll through the choices for each field with the Value pushbuttons. Once the screen is set up as shown, the Enter pushbutton should be depressed to confirm the choices.

The screen shown below should now be visible.

```

1 DS3-DS3                      Final: 00:00:00.00
DS3 Bit:  --                   Sec Ago:  --
  Frm:    --                   --
  C-Bit:  --                   --
  P-Bit:  --                   --
  BPV:    --                   --

DS3:  Tx>DSX3                   Rx>DSX3
      Frm>M13                   Data>2^15-1
      TxClk>Int                 FEBE>111   XBit>1

Err: Type>DS3 Data             Rate>Single

```

Testing is initiated by depressing the START pushbutton. Once the test is started, the elapsed time indicator in the display will be active as well as Alarm and Alarm History lamps on the front panel (as applicable). The user can scroll through the different results screens by depressing the Results pushbuttons.

The test can be stopped at any time by depressing the Stop pushbutton. The user can also freeze the screen while the test continues by toggling the Hold pushbutton. The word Hold appears on the screen and the elapsed time is displayed in reverse video while the hold is active. Results screens can also be stored for later review with the Store pushbutton and can be sent to a printer with the Print Control pushbutton.

EXAMPLE 2: Monitor Testing, DS1 payload within a DS3 signal

This example (See Figure 2.2) employs monitor testing to evaluate a DS1 payload within a DS3 signal. DSX-3 test access is utilized.

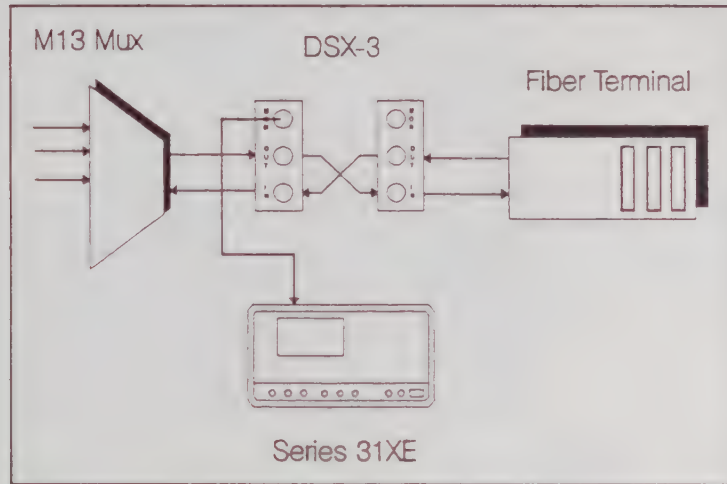
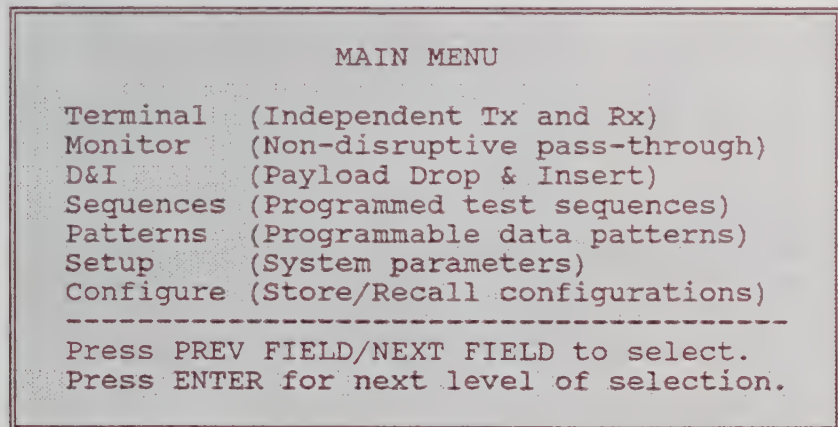


Figure 2.2: DS1 Monitor VIA DSX-3

To perform the testing, Monitor Testing is selected from the opening Main Menu screen. When the instrument is powered up, the Main Menu selection will be visible as shown below. If the Main Menu is not visible, the Menu key can be depressed once or twice to bring it to the screen.



If Monitor Testing is not already highlighted the Field pushbuttons can be depressed (multiple times, if necessary) to scroll forward or backwards through the Main Menu to select Monitor Testing. Once it is highlighted, the Enter pushbutton is pressed select the choice.

At this point, the user chooses the transmit and receive rates as well as the payload as shown in below.

MONITOR TESTING

Rx/Tx Rate: DS3

Payload: DS1

 Select Rx/Tx Rate first
 then select payload.

Press ENTER to enter test mode.
 Press MENU to return to Main Menu.

The values of DS3 for Rx/Tx Rate and DS1 for Payload should be selected. If these values are not displayed, the user should step to the appropriate field (Rx/Tx Rate, Payload) with the Field pushbuttons and then scroll through the choices for each field with the Value pushbuttons. Once the screen is set up as shown, the Enter pushbutton should be depressed to confirm the choices.

The screen shown below should now be visible.

```

  1 DS3-MON (DS1)      Final: 00:00:00.00
DS3 Measurement Summary
Frame: 00000000  -- Sec Ago:  --
P-Bit:          --           --
CP-Bit:         --           --
BPV:            --           --

DS3:  Rx>Monitor      Frm>M13

DS1:  Frm>SF          Code>AMI   Drop>1
      Data>QRSS
  
```

Testing is initiated by depressing the START pushbutton. Once the test is started, the elapsed time indicator in the display will be active as well as Alarm and Alarm History lamps on the front panel (as applicable). The user can scroll through the different results screens by depressing the Results pushbuttons.

The test can be stopped at any time by depressing the Stop pushbutton. The user can also freeze the screen while the test continues by toggling the Hold pushbutton. The word Hold appears on the screen and the elapsed time is displayed in reverse video while the hold is active. Results screens can also be stored for later review with

the Store pushbutton and can be sent to a printer with the Print Control pushbutton.

EXAMPLE 3: Drop & Insert Testing, DS3 with DS1 payloads

The second testing example shows how to drop and insert a DS1 payload in a DS3 signal, once again using DSX-3 access. (See Figure 2.3.) The default (cold-start) configuration values are used, so the DS1 dropped and replaced in the example will be #1 in the DS3 signal.

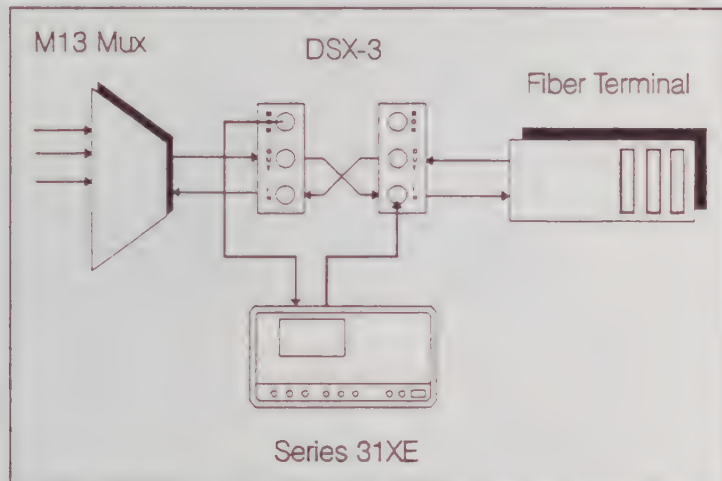
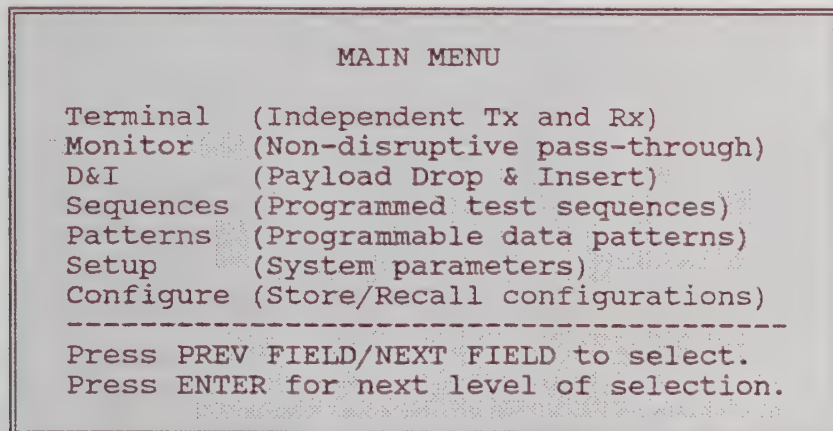


Figure 2.3: DS1 Drop & Insert Testing

To perform the testing, D&I Testing is selected from the opening Main Menu screen. When the instrument is powered up, the Main Menu screen will be visible as shown below. If the Main Menu is not visible, the Menu key can be depressed once or twice to bring it to the screen.



If "D&I (Payload Drop & Insert)" is not highlighted, the Field pushbuttons can be depressed (multiple times, if necessary) to scroll forward or backwards through the Main Menu to select D&I Testing. Once D&I is highlighted, the Enter pushbutton is used to select the choice.

At this point, the user chooses the transmit and receive rate as well as the payload as shown below.

```

                                DROP & INSERT TESTING

Rx/Tx Rate: DS3

Payload: DS1

-----
Select Rx/Tx Rate first
then select payload.

Press ENTER to enter test mode.
Press MENU to return to Main Menu.

```

The values of DS3 for Rx/Tx Rate and DS1 for Payload should be selected as shown. If these values are not displayed, the user should step to the appropriate field (Rx/Tx Rate, Payload) with the Field pushbuttons and then scroll through the choices for each field with the Value pushbuttons. Once the screen is set up as shown, the Enter pushbutton should be depressed to confirm the choices.

The screen shown below should now be visible.

```

1 DS3-D&I (DS1)      Final: 00:00:00.00
DS3 Measurement Summary
Frame:      --      Sec Ago:  --
P-Bit:      --
CP-Bit:      --
BPV:        --

DS3:  Rx>DSX3      Tx>DSX3
      Frm>M13
DS1:  Frm>SF      Data>QRSS
      D&I>1      Code>AMI
Err:  Type>DS1 Data  Rate>Single

```

Testing is initiated by depressing the START pushbutton. Once the test is started, the elapsed time indicator in the display will be active as well as Alarm and Alarm History lamps on the front panel (as applicable). The user

can scroll through the different results screens by depressing the Results pushbuttons.

The test can be stopped at any time by depressing the Stop pushbutton. The user can also freeze the screen while the test continues by toggling the Hold pushbutton. The word Hold appears on the screen and the elapsed time is displayed in reverse while the hold is active. Results screens can also be stored for later review with the Store pushbutton and can be sent to a printer with the Print Control pushbutton.

Chapter 3: Controls and Indicators

This chapter describes the controls, indicators, and connectors on the Series 31XE.

Operational Considerations

The front panel has two sets of displays. Individual LEDs are used in conjunction with a twelve line alphanumeric LCD display. Together, these displays provide continuous indication of instrument and test operation. Menu displays prompt the user to select from a variety of configuration information, patterns, results display levels and test parameters. The displays are also used to show the results of each test.

The primary information fields are displayed on the twelve line alphanumeric panel. Complete menu information, status information and test results are shown. In general, information displayed depends on the operational modes and pushbutton options that the user has selected.

Default Settings and Cold Start

The Series 31XE, through software, uses standard settings for each of the modes of operation. These default settings can be changed by the user at any time, to accommodate advanced diagnostics or specialized setups. Once the default (standard) settings are altered, the Series 31XE remembers the new settings and will return to them even after power has been accidentally interrupted or the machine has been turned off. If the user needs to restore the instrument to its original default settings, this is done by turning off the Series 31XE, depressing and holding the STOP pushbutton and turning the power back on. This procedure, called Cold Start, will return the instrument to the factory default settings. During Cold Start, the user is given the opportunity to clear any stored test setups by depressing the Start button.

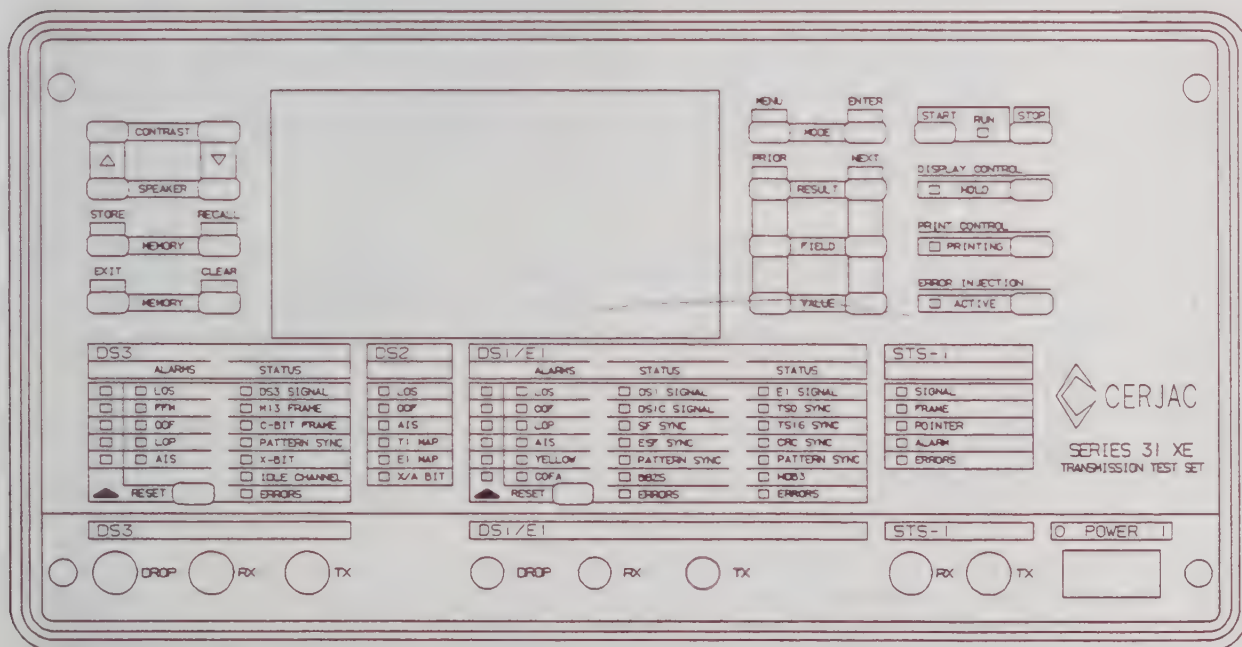
On power up, the Series 31XE performs a set of diagnostic functions. The user is then presented with the opening menu screen shown below.

MAIN MENU

Terminal (Independent Tx and Rx)
 Monitor (Non-disruptive pass-through)
 D&I (Payload Drop & Insert)
 Sequences (Programmed test sequences)
 Patterns (Programmable data patterns)
 Setup (System parameters)
 Configure (Store/Recall configurations)

Press PREV FIELD/NEXT FIELD to select.
 Press ENTER for next level of selection.

The remainder of this chapter will provide a detailed description of the front and rear panel controls, indicators and connectors, including the controls used to interact with the LCD screen. Chapters 4 and 5 present detailed information on the use of the menus themselves.



Front Panel Controls

The front panel is shown above. A large 12 line alphanumeric display is used as the primary user interface. This 40-column display presents choices, parameters and test results in an easy-to-read format.

Displayed information is stored and can be printed automatically or on demand.

A switch on the lower right side of the front panel turns the instrument on and off.

With the exception of the power switch and the display contrast adjustment, all front panel controls consist of individual pushbuttons arranged in logical groups.

Eight pushbuttons are used to change default values and settings to accommodate different modes of operation, two are used to reset alarm history indicators, and four are used to store, recall and clear test results. Pushbuttons are also used to control the contrast of the LCD screen, and the volume of the speaker. The remaining five pushbuttons control testing and display/printout functions.

The Series 31XE has different modes of operation which are described in Chapters 4 and 5. Each mode of operation uses a series of parameters that are test-specific. On the display, a group of configuration selections gives the user choices relevant to the particular operating mode. The operating modes are accessed using menus. The **MENU** and **ENTER** pushbuttons allow the user to scroll up and down through menus that select the specific operation of the Series 31XE. **MENU** is used to step up toward the main (opening) menu while **ENTER** is used to step down through the views.

There are, at most, 2 menu levels allowing the main menu to be accessed at any time by depressing the **MENU** pushbutton one or two times. Depressing the **ENTER** pushbutton accepts the selected menu information causing the display to move to the next menu level.

If the user wishes to change the displayed default values, the **FIELD** pushbuttons cycle through the different changeable operating parameters. The left button cycles backwards while the right button moves the menu highlight forward through the fields.

After selecting an operating parameter, the two **VALUE** pushbuttons can be used in the same manner to cycle through and select pre-programmed values for the chosen operating parameter.

Testing is controlled by a second set of pushbuttons. The **START** and **STOP** pushbuttons initiate and suspend testing once the modes and operating parameters have been established. Testing can also be paused (and resumed) by depressing the **START** pushbutton a second (and third) time.

A RUN indicator illuminates whenever testing is in progress.

A single button marked HOLD freezes the display allowing the user to observe a particular set of results while the current test continues in the background. The elapsed time indicator field on the display is replaced with the word HOLDING. A HOLD LED also illuminates to indicate that the display is being held.

The PRINT CONTROL pushbutton causes results screens and current test configuration information to be printed. Printing can be programmed to occur automatically. (See Chapter 5.) However, this button can be used to override automatic settings and cause printing to occur immediately. A PRINTING LED illuminates any time a printing operation is active. Printed information includes the test setup information as well as all test results screens for the current test mode. If there is no active printer present, the first print request will be sent to an internal queue where the results will remain until a printer is attached or the Series 31XE is powered down.

The ERROR INJECTION pushbutton provides manual injection of selected error types. This is used in certain test modes to create errors in framing, parity, or data or to initiate alarm conditions. The Series 31XE can then monitor the reaction of devices under test to the errors. Chapter 4 describes error programming. As with other test controls, an LED indicates when error injection is active.

Four pushbuttons on the upper left side of the Series 31XE front panel control operation of the twelve test results storage buffers. The active buffer stores test setups and parameters whenever the STORE pushbutton is depressed. In this manner, the user can store test results for later recall. RECALL is used to step through the stored data and EXIT is used to cancel the programmed selections and return the test set operation to whatever mode it was in prior to recall. The CLEAR pushbutton is used to clear all twelve buffers.

The active buffer, numbered from 1 to 12, is displayed as a number in the upper left hand corner of the screen.

Also on the upper left side of the front panel are the pushbutton controls for CONTRAST and SPEAKER.

Alarm, History, Status, and Error Indicators

The lower front panel of the Series 31XE contains four islands of information grouped by transmission rate (DS3, DS2, DS1/E1, and STS-1). For each rate, there are LED

indicators for alarm, alarm history and status information. Alarm history LEDs for DS3, DS1 and E1 can be manually reset with corresponding RESET pushbuttons.

The Series 31XE detects a range of alarm conditions and displays them on the display screen as well as illuminating a corresponding red LED during the period that the alarm is detected. The detection criteria are described below for each of the alarm conditions. Note that a yellow alarm history LED remains illuminated after the alarm condition clears. The history LEDs may be manually cleared by depressing the RESET pushbuttons.

Alarm and alarm history LED's become active when a test starts, and latch the final test conditions when a test is stopped.

Green status indication LEDs provide information about received signals. Unlike alarm and alarm history LED's which are only active after a test has been started, the status indicators change dynamically to reflect input signal conditions whenever the mode screen is displayed.

Yellow Error indicators are also included for DS3, DS1, E1, and STS-1 rates. An error LED lights if an error of the identified type occurs during any quarter second period. Like alarm indicators, error LED's are active only while a test is running, and latch the final test conditions when the test is stopped.

The alarm, alarm history, status, and error indicators on the front panel are described below. In certain cases, alarm and status indications appear on the LCD screen and not as front panel lights. These are included in the definitions which follow.

STS-1 Alarm and History Indicators

LOS Loss of Signal: Detection of an all zeros pattern on the STS-1 signal which persists for at least 10 microseconds illuminates the LED. The LOS condition must be detected before 100 microseconds of all zeros, and must not be detected before 10 microseconds. (Nominal detection time is 55 microseconds.) LOS is cleared when a non-zero pulse is received.

LOF Loss of Frame: When receiving an STS-1 signal, the STS LOF indicates that an OOF condition (4 consecutive errored framing patterns) has existed for 24 consecutive frames (3 mS). The LOF terminates after 24 consecutive frames of correct framing patterns.

- LOPNTR** STS Loss of Pointer: This alarm is declared after 8 consecutive frames in which the H1/H2 value has not met at least one of the following conditions:
- 1) Normal flag (0110) and valid value (0 - 782).
 - 2) New data flag (1001) and valid value (0 - 782).
 - 3) Normal flag and valid value in STS-1 #1 and Concatenation indicator (1001XX1111111111) in STS-1 #2 and #3.
- The LOPNTR alarm will not be declared during Path AIS. The LOPNTR alarm is cleared if a consistent new valid pointer is detected for 3 consecutive frames.
- LOCLK** Loss of Clock: When programmed for external clock a loss of the external clock signal will illuminate this LED.
- STS PAIS** STS-1 Path AIS: All 1's received in H1 and H2 for 3 consecutive frames will set this alarm LED. It will be cleared after 3 consecutive frames in which the H1 and H2 do not contain all 1's.
- STS PYEL** STS-1 Path Yellow: If 10 consecutive frames contain a 1 in bit 5 of overhead byte G1, then STS Path Yellow is declared. The alarm is cleared after 10 consecutive frames containing a 0 in G1 bit 5.
- LAIS** Line AIS: If 5 consecutive received K2 bytes contain XXXXX111, then Line AIS is declared. LAIS is cleared when 5 consecutive received K2 bytes do not contain XXXXX111.
- LFERF** Line Far End Receive Failure: If 5 consecutive K2 bytes contain XXXXX110, then Line FERF is declared. LFERF is cleared when 5 consecutive received K2 bytes do not contain XXXXX110.

STS-1 Status LEDs

- SIGNAL** This LED is illuminated whenever an STS signal is detected.
- FRAME** When no OOF (Out Of Frame) condition has existed for 24 frames, this LED will illuminate.
- POINTER** Reception of a consistent H1/H2 pointer value in three consecutive frames will be indicated by this LED.

STS-1 Error Indicator

ERRORS This LED lights when a BIP-8-violation is detected based on the received B1, B2, or B3 parity bytes, or when a value greater than 0 but less than 9 is received in bits 1 through 4 of the received G1 path overhead byte (indicating Far End Block Errors, FEBE).

Virtual Tributary Alarm Indicators

PAIS VT1.5 Path AIS: This alarm is declared if all one's are detected in the V1 and V2 overhead bytes for 3 consecutive frames. The alarm condition is cleared when V1 and V2 values which are not all one's are received for 3 consecutive frames.

PYEL VT1.5 Path Yellow: This alarm is declared if a one is detected in bit 8 of overhead byte V5 for ten consecutive VT superframes. It is cleared when a zero is received in bit 8 of V5 for ten consecutive VT superframes.

LOPNTR VT Loss of Pointer: This alarm will be declared if a valid pointer is not found in 8 consecutive frames. It is cleared when a consistent valid pointer value is detected in 3 consecutive frames.

Virtual Tributary Error Indicators

V5 CV The V5 CV indicator lights if there are code violations based on reception of the BIP2 parity in VT path overhead byte V5.

FEBE The FEBE LED lights if bit 3 of the received V5 byte equals one, indicating Far End Block Errors in the VT path.

DS3 Alarm and History Indicators

LOS Loss of Signal: A LOS is detected when there have been 128 or greater contiguous pulse positions with no pulses of either positive or negative polarity. An LOS event is terminated at the occurrence of a pulse.

FFM Frame Format Mismatch: A FFM exists when the frame format detected does not match the frame format selected and no OOF or AIS conditions exist for 3 consecutive seconds. The alarm is cleared when

these conditions are not met for 3 consecutive seconds.

- OOF Out of Frame: An OOF alarm occurs when the internal test set receiver cannot find either F-Sync or M-Sync frame synchronization. The Series 31XE has an advanced DS3 framer which maintains F-bit synchronization during very high error rate conditions. For example, at $1.0E-2$ bit error rate the mean time to lose frame synchronization approaches 1000 hours. The framer can tolerate 1020 bit bursts of 100% errors before losing frame. The criteria for losing M-synchronization is 2 M-group errors out of 3 successive M-groups. An M-Group is an M0, M1, M0 sequence. An M-group error is defined as an M0, M1, M0 sequence not equal to 0,1,0.
- LOP Loss of Pattern: A LOP condition occurs when data pattern synchronization is not achieved or the received data pattern does not correspond to the internally generated reference. To achieve synchronization requires 64 consecutive error-free comparisons of the received data to the internally generated reference pattern. To lose pattern synchronization requires 240 bit errors out of 1024 consecutive data bits.
- AIS DS3 Alarm Indication Signal: An AIS alarm is declared when the AIS signal is present for 3 consecutive one second intervals. This condition is detected in the presence of a random error rate of $1.0E-3$. The DS3 AIS signal is defined as a 1010 data pattern with valid framing, the 1 following a framing bit, and all C-Bits equal to zero.
- LCVA Line Code Violation Alarm: An LCVA is declared when 3 consecutive one second intervals contain an LOS or a BPV error rate greater than $1.0E-6$ (44 errors/sec). The alarm is cleared when there is no LOS and the error rate is less than $1.0E-7$ (4 errors/sec) for 3 consecutive seconds. The line code violation alarm history is activated upon termination of the first LCVA condition.

DS3 Status Indicators

DS3 SIGNAL DS3 signal detection is based on reception of at least 128 contiguous pulses.

M13 FRAME Proper F-Sync and M-Sync have been found, and the number of C11 (FID) bits=0 was at least 16 over the last 0.25 second.

C-BIT FRAME Proper F-Sync and M-Sync have been found, and the number of C11 (FID) bits=0 was less than 16 over the last 0.25 second.

PATTERN SYNC To gain pattern synchronization requires 64 consecutive error free comparisons of the received data with the internally generated reference pattern. To lose pattern synchronization requires 240 bit errors out of 1024 consecutive bits.

X-BIT Detection of zero values for both of the X-Bits within the frame will illuminate the LED.

IDLE CHANNEL The Idle Channel Signal is a signal with valid M-frame alignment, M-subframe alignment, and P-Bit Parity. The information bits are set to a 1100 sequence, starting with a 11 after each framing and control bit. The C-bits are set to zero in M-subframe 3. The X-bits are set to one (X1=1 and X2=1). An Idle Channel Signal condition is detected in the presence of a random error rate of $10E-3$.

DS2 Alarm and Status Indicators

LOS: Loss of Signal: LOS is declared when there have been 192 consecutive DS2 bits equal to zero. An LOS event is terminated at the occurrence of a DS2 bit equal to one.

OOF: Out of Frame: To gain DS2 F-sync requires 15 consecutive error free F-bits. To gain DS2 M-Sync requires two consecutive error-free M-bit sequences (M0,M1,M1).

To lose DS2 F-sync requires 3 F-bit errors out of 15 consecutive F-bits. To lose DS2 M-sync requires 2 errored M-bit sequences out of 3 consecutive M-bit sequences.

AIS: Alarm Indication Signal: DS2 AIS is declared upon the detection of an all ones, unframed signal. The all ones detection requires a 99.9% ones density.

X-Bit: DS2 X-Bit status is ON when the received X-Bit is a one.

DS1 Alarm and History Indicators

- LOS** Loss of Signal: A LOS is declared when there have been 175 or greater contiguous pulse positions with no pulses of either positive or negative polarity. An LOS event is terminated on receipt of a signal with 12.5% or greater ones density.
- OOF** Out of Frame: An OOF condition occurs when 2 out of 4 framing bits have been detected in error. Ft and Fs bits are tested for OOF in SF framing. Ft bits are tested in SLC-96 and MBLT framing. FPS bits are tested in ESF framing.
- LOP** Loss of Pattern: A LOP occurs when data pattern synchronization is not achieved or the received data pattern does not correspond to the internally generated reference. To achieve synchronization requires 64 consecutive error free comparisons of the received data with the internally generated reference pattern. To lose pattern synchronization requires 250 bit errors out of 1024 consecutive data bits. (For user-programmable patterns with less than 25% transition density, loss of pattern synchronization is declared based on 85 bit errors in 1024 consecutive data bits.)
- AIS** DS1 Alarm Indication Signal: A DS1 AIS signal is declared on detection of an all ones unframed pattern. An all ones pattern is detected if 2 consecutive frames contain fewer than 3 zeros. The condition must persist for 3 seconds before the AIS indicator is activated.
- YEL** Yellow Alarm: In SF framing mode a Yellow Alarm is declared when bit 2 of 256 or more consecutive DS0 timeslots are zero. In ESF framing mode a Yellow Alarm is declared when 16 pattern sets of 00 (HEX) and FF (HEX) are received on the facility data link channel.
- COFA** Change of Frame Alignment: A COFA is declared when the framer resynchronizes to a new frame or multiframe alignment after an OOF condition. A COFA history indication is activated upon the termination of the first COFA condition.
- 1'S Den:** Ones Density, or Pulse Density: A 1's Density alarm condition is declared on detection of a block of 128 bit times with less than 16 ones (12.5%), or a string of 15 or more consecutive zeros.

DS1 Status Indicators

DS1 SIGNAL Upon detection of a 12.5% pulse density, this LED will illuminate.

SF SYNC Detection of a valid SF (Super Frame) format illuminates this lamp. To gain synchronization requires 24 consecutive error free F-bits.

ESF SYNC This lamp illuminates with detection of valid ESF (Extended Super Frame) format. To gain synchronization requires 24 consecutive error free FPS-bits.

PATTERN SYNC To gain pattern synchronization requires 64 consecutive error free comparisons of the received data with the internally generated reference pattern. To lose pattern synchronization requires 240 bit errors out of 1024 consecutive bits. (For user-programmable patterns with less than 25% transition density, loss of pattern synchronization is declared based on 85 bit errors in 1024 consecutive data bits.)

B8ZS The B8ZS status LED will illuminate any time valid B8ZS zero substitution codes are detected on the incoming DS1 Rx signal.

DS1C Status Indicators

DS1C SIGNAL Declared upon detection of 175 or more contiguous pulses.

E1 Alarm Indications

LOS: Loss of Signal: A LOS is declared when there have been 175 or greater contiguous pulse positions with no pulses of either positive or negative polarity. An LOS event is terminated at the occurrence of a pulse.

OOF: Out of Frame: The OOF indicator is activated whenever the frame alignment word is received in error for three consecutive frames.

LOP: Loss of Pattern: A LOP occurs when data pattern synchronization is not achieved or the received data pattern does not correspond to the internally generated reference. To achieve synchronization requires 64 consecutive error free comparisons of the received data with the internally generated reference pattern. To lose pattern synchronization requires 250 bit errors out of 1024 consecutive data bits. (For user-programmable patterns with

less than 25% transition density, loss of pattern synchronization is declared based on 85 bit errors in 1024 consecutive data bits.)

AIS: E1 Alarm Indication Signal: An E1 AIS signal is declared on detection of two consecutive frames with fewer than 3 zeros. This is equivalent to an unframed all ones condition.

Remote: Yellow Alarm, or Remote Alarm: Set when bit 3 of received timeslot 0 = 1 for three consecutive non-align frames.

Distant: Distant Multiframe Alarm: Set when bit 6, frame 0, of timeslot 16 = 1 for three consecutive multiframes.

Ex O's: Excess Zeros Alarm: Excess Zeros Alarm is declared for AMI coded signals when greater than 15 consecutive zeros are received. For HDB3 coding, receipt of greater than 3 consecutive zeros triggers the alarm.

E1 Status Indications

E1 SIGNAL: Upon detection of 256 or more contiguous pulses, this indicator will become true.

TS0 SYNC: Detection of valid TS0 framing activates this indicator.

TS16 SYNC: This indicates detection of valid Channel Associated Signalling framing.

CRC4 SYNC: This indicates valid CRC4 framing.

PATTERN SYNC: To gain pattern synchronization requires 64 consecutive error free comparisons of the received data with the internally generated reference pattern. To lose pattern synchronization requires 240 bit errors out of 1024 consecutive bits.

HDB3: The HDB3 status indicator will activate any time valid HDB3 zero substitution codes are detected on the incoming E1 Rx signal.

Front Panel Connectors

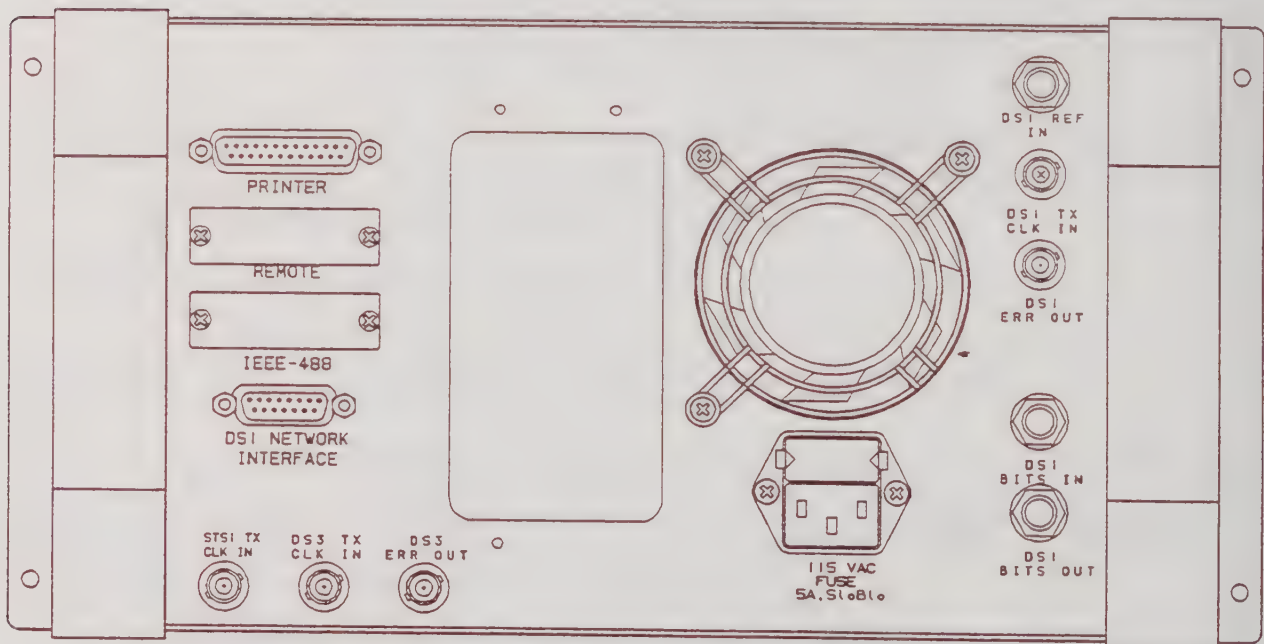
Commonly used signal connectors are on the front panel of the Series 31XE. Several additional connections are available on the rear panel. Note that signal levels and line codes are programmable by the user. Electrical

specifications for the connections can be found in Chapter 7.

The lower portion of the front panel is conveniently divided into three sections for DS3, DS1/E1 and STS-1 signals. There are separate front panel connections for DS3 receive, transmit, and drop signals using WECO440 compatible connectors. (Optional BNC or 358 connectors are also available.)

The DS1 signals also have receive, transmit, and drop connections. DS1 connections use WECO310 compatible connectors or optional Bantam connectors.

STS-1 connections are provided for transmit and receive. STS-1 connections use WECO440 compatible connectors, or optional BNC or 358 connectors.



Rear Panel Signal Connectors

DS1 transmit outputs and receive inputs are also available on a rear-panel 15-pin D-style connector, in parallel with the front panel DS1 transmit and receive connectors.

When external clocks are used with DS1 or DS3 signals, rear panel connectors receive clock inputs at TTL levels.

A WECO310 connector is used for a DS1 reference input. This accommodates the DS1 controlled frame slip measurement.

DS3 and DS1 bit error outputs are also available on rear-panel BNC connectors. These signals provide a single pulse for each DS3 or DS1 bit error detected.

For STS-1 testing, the rear panel has a unipolar NRZ STS-1 clock input, as well as DS1 BITS timing input and output.

A TTL burst error input is used for controlling error injection. When the level is high, error injection is active.

Two separate RS-232 ports are provided. One is used for a 40 or 80 column printer. The printer port is controlled by the user. Timed print on command or immediate printing can be used to print results screens.

The second RS-232 port is used for software download, and for the remote control option. The remote control option is used to attach a terminal or PC via an external modem.

The optional IEEE-488 port is also located on the rear panel.

Chapter 4: Testing with the Series 31XE

Testing with the Series 31XE is initiated and controlled via the menus on the LCD screen. Chapter 3 includes a description of accessing and manipulating the menus using the MENU, ENTER, FIELD, and VALUE pushbuttons.

Any time a test is not running, the MENU key can be pressed one or two times to bring the MAIN MENU to the screen:

MAIN MENU

Terminal (Independent Tx and Rx)
Monitor (Non-disruptive pass-through)
D&I (Payload Drop & Insert)
Sequences (Programmed test sequences)
Patterns (Programmable data patterns)
Setup (System parameters)
Configure (Store/Recall configurations)

Press PREV FIELD/NEXT FIELD to select.
Press ENTER for next level of selection.

The first four choices in the MAIN MENU are for performing tests. The highlighted cursor is moved to the desired testing choice using the FIELD keys. The ENTER key is then depressed to select the highlighted choice.

MAIN MENU SELECTION: Terminal

Terminal Testing is used with a variety of transmission and multiplexing equipment and is generally performed in out of service conditions. An example of a terminal testing setup is shown in Figure 4.1.

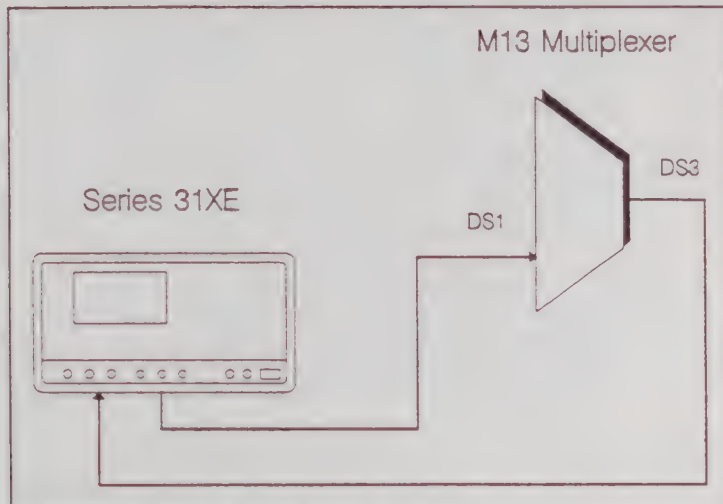


Figure 4.1: Terminal Testing Example

Whenever a test signal is needed as an input to the system being tested, Terminal Testing should be selected. Often, as shown in the figure, the test set transmits a test signal at one rate and receives a different rate back. This would be for a multiplexer or demultiplexer test. In other cases, a straight transmission test is performed where the same rate is both transmitted to and received from the system under test.

Using Terminal Testing, the Series 31XE allows independent configuration of the transmit and receive rates to allow testing of a wide variety of SONET, T-Carrier, and Hybrid equipment and installations.

When Terminal Testing is selected from the MAIN MENU by pressing ENTER, the following screen is displayed:

```

      TERMINAL TESTING

Tx Rate: DS1                      Rx Rate: DS3

Payload: DS1

-----
Select Tx and Rx first
then select payload.

Press ENTER to enter test mode.
Press MENU to return to Main Menu.
```

The user is presented with a choice of transmit and receive rates as well as payload mappings. Using the

FIELD and VALUE keys, the Tx Rate is selected from DS1, E1, DS3, and STS1. These transmission rates will be generated by the Series 31XE. The user may then independently select the appropriate receive signal rate (DS1, E1, DS3, or STS1). Payload signal mappings are selected to suit the application. The payload choices presented to the user are dependent upon the selected transmit and receive rates.

For the example shown in Figure 4.1, Tx Rate: would be set to DS1, Rx Rate: would be set to DS3, and Payload: would be set to DS1. After the rate and payload choices are made, the ENTER key is pressed again. When the ENTER key is pressed this time, a Terminal Testing Mode is entered. On entering the mode, the test set begins transmitting a signal at the selected Tx Rate. The selected Rx Rate is also immediately monitored. Green STATUS indicators light if the desired Signal, Frame, etc, are detected. Test results are not displayed, however, and the red ALARM indicators are not enabled, until a test is initiated using the START key.

When the Terminal Testing Mode for Figure 4.1 is entered, the following screen is displayed:

```

  1 DS1-DS3 (DS1)           Final:  00:00:00.00
DS3 Measurement Summary
Frame:      --      Sec Ago:  --
P-Bit:      --
CP-Bit:      --
BPV:         --

DS3:   Rx>DSX3           Frm>M13
DS1:   Tx>DSX1           Code>AMI
        Frm>SF           Data>QRSS
        Drop>1
Err/Alm>Type>DS1 Data   Rate>Single

```

The number "1" in the top left corner indicates that data storage buffer 1 will be used the next time the front panel STORE or RECALL button is pressed.

Following the number "1" is the mode name. Whenever the Series 31XE is in a test mode, the mode name is displayed in this position. Notice that the mode name is simply a repetition of the choices made for Tx Rate, Rx Rate, and Payload. In this case, these are Tx Rate: DS1, Rx Rate: DS3, and Payload: DS1, resulting in the mode name "DS1-DS3 (DS1)".

The last item in the top line is the Final or Elapsed test time, depending on whether a test has completed or is still in progress.

The next five lines, displayed in reverse video, are for display of test results. The results are presented on multiple screens, each occupying these five lines of the display. The different results screens are accessible by pressing the RESULTS pushbuttons. The number of result screens as well as the detail presented on each screen depend on the specific transmit, receive and payload selections which have been made. Definitions for the displayed results are given in Chapter 6.

When the START button is pressed, the Series 31XE begins analysis of the received signal. Signal analysis continues until the test is stopped. If any alarm conditions exist in the received signal, the red front panel alarm indicators will activate when the test is started. The conditions on the alarm lights freeze when the test is stopped, maintaining a record of the final conditions of the test. (Note that the green status lights, on the other hand, remain active whenever the mode screen is displayed, giving a constant dynamic indication of the received signal conditions.)

Test control can be manual, using the START and STOP buttons, or it can be under automatic control for timed or repetitive testing, using setups in the Global Test Setups screen. This screen is described in Chapter 5.

The lower six lines of the display are for changing the detailed test configurations. Every distinct mode has its own set of control parameters, and default values for these configurations. The operator of the test set can change any setting by pressing the FIELD buttons to move the cursor to the desired parameter, and then change that setting by pressing the VALUE keys. The user's new values are then restored whenever the mode is entered. (Factory default values can be restored using the "Cold Start" procedure, described in Chapter 3.)

The particular choices available in the lower part of the screen depend on the selections made for Tx Rate, Rx Rate, and Payload. The section entitled "Configuration Values", later in this chapter, describes all of the possible configuration choices.

It is also possible to access alternate configuration screens in the lower part of the display. These screens are used to control specialized functions, and are accessed by repeatedly pressing the ENTER button after entering a test mode. These screens are described later

in this chapter in a section entitled "Alternate Configuration Screens".

MAIN MENU SELECTION: Monitor

With Monitor Testing, the Series 31XE examines an incoming signal, gathers error and performance statistics, and logs alarms conditions. Monitor Testing is useful for a variety of in-service tests. Electrical DSX monitor ports may be available for STS-1, DS3, or DS1 signals. Monitored signals are regenerated by the Series 31XE to provide down-stream keep-alive signals.

An example of Monitor operation is shown in Figure 4.2. The DSX-3 monitor signal is connected to the Series 31XE. An individual DS1, corresponding to a customer premise Channel Service Unit (CSU) can then be dropped and tested.

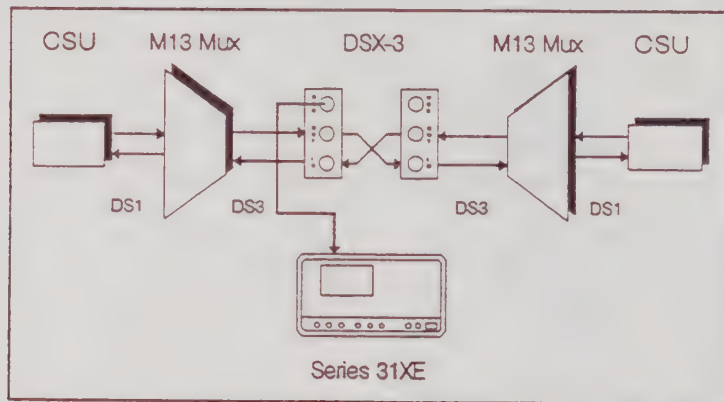


Figure 4.2 Monitor Testing Example

Monitor Testing uses the same menu-driven approach described above for Terminal Testing. When Monitor Testing is selected from the main menu, the following screen is displayed:

MONITOR TESTING

Rx/Tx Rate: DS3

Payload: DS1

Select Rx/Tx Rate first
then select payload.

Press ENTER to enter test mode.
Press MENU to return to Main Menu.

In Monitor Mode, the user selects a single rate for Receive and Transmit since the received signal is always passed through to the transmit port. Rx/Tx Rate: may be set to STS1, DS3, or DS1. The desired payload is then chosen.

For the example shown in Figure 4.2, Rx/Tx Rate: should be set to DS3, and Payload: should be set to DS1. After the rate and payload choices are made, the ENTER key is pressed. When the ENTER key is pressed this time, a Monitor Testing mode is entered, and monitoring of the selected Rx/Tx Rate begins. Green STATUS indicators light if the desired Signal, Frame, etc, are detected. Test results are not displayed, however, and the red ALARM indicators are not enabled, until a test is initiated.

When the Monitor Testing mode for Figure 4.2 is entered, the following screen is displayed:

```
  1 DS3-MON (DS1)      Final:  00:00:00.00
DS3 Measurement Summary
Frame:      --      Sec Ago:  --
P-Bit:      --      --
CP-Bit:      --      --
BPV:        --      --

DS3:   Rx>Monitor      Frm>M13

DS1:   Frm>SF          Code>AMI   Drop>1
      Data>QRSS
```

The number "1" in the top left corner indicates that data storage buffer 1 will be used the next time the front panel STORE or RECALL button is pressed.

Following the number "1" is the mode name. The mode name is simply a repetition of the choices made for Rx/Tx Rate and Payload, with the letters MON indicating that this is a Monitor Testing mode. In this case the mode name is DS3-MON (DS1).

The last item in the top line is the Final or Elapsed test time, depending on whether a test has completed or is still in progress.

The next five lines, displayed in reverse video, are for display of test results. The results are presented on multiple screens, each occupying these five lines of the display. The different results screens are accessible by pressing the RESULTS pushbuttons. The number of result screens as well as the detail presented on each screen will vary depending on the specific transmit, receive and payload selections. Definitions for the displayed measurements are given in Chapter 6.

When a test starts, the Series 31XE begins analysis of the received signal. Signal analysis continues until the test is stopped. As described above for Terminal Testing, the red alarm indicators are active while the test is running, and latch the final test values when the test stops. The green status lights, on the other hand, remain active whenever the test mode screen is displayed.

Test control can be manual, using the START and STOP buttons, or it can be under automatic control using setups in the Global Test Setups screen, described in Chapter 5.

The lower six lines of the display are for changing the detailed test configurations. Every distinct mode has its own set of parameters and default values. These values can be changed by the operator of the test set by pressing the FIELD buttons to move the cursor to the desired parameter, and then changing the setting by pressing the VALUE keys. The user's new values are then restored whenever the mode is entered. (Factory default values can be restored using the "Cold Start" procedure, described in Chapter 3.)

The particular choices available in the lower part of the screen depend on the selections made for Rx/Tx Rate, and Payload. The section entitled "Configuration Values", later in this chapter, describes all of the possible configuration choices.

It is also possible to access alternate configuration screens in the lower part of the display. These screens are used to control specialized functions, and are accessed by repeatedly pressing the ENTER button after entering a test mode. These screens are described later in this chapter in a section entitled "Alternate Configuration Screens".

MAIN MENU SELECTION: D&I

With Drop & Insert testing, the Series 31XE passes the received signal through to the appropriate transmit port, as it does for Monitor Testing. In this case, however, the signal is modified by allowing the user to drop and measure a particular channel or payload within the signal, and to replace that channel in the outgoing signal.

Figure Figure 4.3 gives an example of Drop & Insert operation. In the example, a DS1 from a customer premise CSU is multiplexed into a DS3 signal. The DS3 signal is accessed at the DSX-3 bay, where the Series 31XE drops and replaces the target DS1 payload. This allows the circuit to be sectionalized at the DS1 level even though the only Central Office access is at DS3 rates.

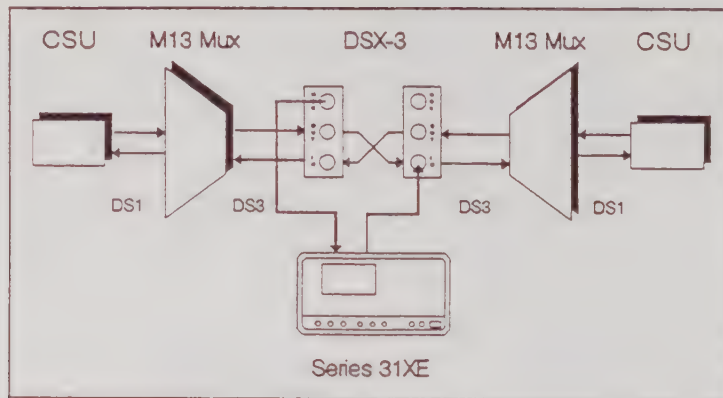


Figure 4.3: Drop & Insert Testing Example

The menu operations for Drop & Insert Testing are almost identical to those described above for Terminal and Monitor Testing. When Drop & Insert Testing is selected from the main menu, the following screen is displayed:

```

DROP & INSERT TESTING

Rx/Tx Rate: DS3

Payload: DS1

-----

Select Rx/Tx Rate first
then select payload.

Press ENTER to enter test mode.
Press MENU to return to Main Menu.

```

As for Monitor Testing, Drop & Insert Testing requires the user to select a single rate for Receive and Transmit. Rx/Tx Rate: may be set to STS1 or DS3. The desired payload is then chosen.

For the example shown in Figure 4.3, Rx/Tx Rate: would be set to DS3, and Payload: would be set to DS1. After the rate and payload choices are made, the ENTER key is pressed again. When the ENTER key is pressed this time, a Drop & Insert Testing mode is entered. On entering the mode, the selected Rx/Tx Rate is immediately monitored. Green STATUS indicators light if the desired Signal, Frame, etc, are detected. Test results are not displayed, however, and the red ALARM indicators are not enabled, until a test is initiated.

When the Drop & Insert Testing Mode for Figure 4.3 is entered, the following screen is displayed:

```

1 DS3-D&I (DS1) Final:00:00:00.00
DS3 Measurement Summary
Frame:00000000--Sec Ago:  --
P-Bit:      --
CP-Bit:     --
BPV:        --

DS3:  Rx>DSX3  Tx>DSX3
      Frm>M13
DS1:  Frm>SF  Data>QRSS
      D&I>1    Code>AMI
Err:  Type>DS1 Data  Rate>Single

```

The number "1" in the top left corner indicates that data storage buffer 1 will be used the next time the front panel STORE or RECALL button is pressed.

Following the number "1" is the mode name. The mode name is simply a repetition of the choices made for Rx/Tx Rate and Payload, with the letters D&I indicating that this is a Drop & Insert mode. In this example the mode name is DS3-D&I (DS1).

The last item in the top line is the Final or Elapsed test time, depending on whether a test has completed or is still in progress.

The next five lines, displayed in reverse video, are for display of test results. The results are presented on multiple screens, each occupying these five lines of the screen. The different results screens are accessible by pressing the RESULTS pushbuttons. The number of result screens as well as the detail presented on each screen depends on the choices made for transmit rate, receive rate, and payload. Definitions for the displayed measurements are given in Chapter 6.

When the START button is pressed, the Series 31XE begins analysis of the received signal. Signal analysis continues until the test is stopped. The red alarm indicators are active during the time that the test is running, and latch the final test conditions when the test is stopped. The green status indicators, however, remain active whenever the test mode screen is displayed.

Test control can be manual, using the START and STOP buttons, or it can be under automatic control using setups in the Global Test Setups screen, described in Chapter 5.

The lower six lines of the display are for changing the detailed test configurations. Every distinct mode has its own set of configuration parameters and default values. These values can be changed by the operator of the test set by pressing the FIELD buttons to move the cursor to the desired parameter, and then changing that setting by pressing the VALUE keys. The user's new values are then restored whenever the mode is entered. (Factory default values can be restored using the "Cold Start" procedure, described in Chapter 3.)

The particular choices available in the lower part of the screen depend on the selections made for Tx/Rx Rate and Payload. The section entitled "Configuration Values", later in this chapter, describes all of the possible configuration choices.

It is also possible to access alternate configuration screens in the lower part of the display. These screens are used to control specialized functions, and are accessed by repeatedly pressing the ENTER button after entering a test mode. These screens are described later in this chapter in a section entitled "Alternate Configuration Screens".

Configuration Values

When running any test mode, whether it be Terminal, Monitor, or Drop & Insert testing, the user has the option of changing setup values in the lower half of the screen. Depending on the rates and payloads selected for the test, different combinations of configurable values are available on the screen. In the following pages, the possible configuration choices are described.

STS-1 Test Configurations

TxCk> There are four different choices for TxCk, the SONET transmit clock source. Note that the SONET clock is independent of the clocks for the asynchronous signals that are mapped into the payload. TxCk>Int selects the internal Stratum 3 clock. Alternatively, the clock can be set to TxCk>Ext 52M to use an external 51.84 Mhz clock supplied through the rear panel BNC connector. TxCk>BITS can also be selected if the BITS option is installed. TxCk>Loop selects loop timing, where the clock is extracted from the received SONET signal.

Scramble> The SONET standard provides for a frame synchronous scrambler of length 127 to allow extraction of the clock signal during extended transmissions of all zero or all one bits. The Series 31XE gives the user the option of turning scrambling on (Scramble>On) or off (Scramble>Off) for the front panel STS-1 transmit and receive ports.

Rx> For modes with STS-1 receive rates, Rx>STSX1 selects STSX levels for the front panel STS-1 receive port. Rx>High, Rx>Low, and Rx>Monitor are other choices for the front panel STS-1 receive port.

STS-1 Error Injection

Type> The Series 31XE can inject a wide variety of SONET error types at selectable rates to test operation and alarm detection of equipment under test. Users can program different errors into the assembled signal using the Type> and Rate> fields and then observe equipment response to these errors. The actual error conditions are programmable by the user to meet a wide range of situations and test scenarios.

Type>Section BER: Section Bit Error Rate injection affects the entire SONET signal with the exception of the A1, A2, and B1 bytes.

Type>Line BER: Line Bit Error Rate injection affects the entire SONET signal with the exception of the Section Overhead, and the B2 parity byte.

Type>Path BER: Path Bit Error Rate injection causes errors in the Path and Path Overhead, with the exception of the B3 parity byte.

Type>B1 Byte: When the Error Injection button is pressed, the B1 parity byte is inverted for one frame in the outgoing SONET signal. This should result in detection of 8 Section Code Violations at the receiving end. Note that byte inversion acts on the parity byte itself, while Bit Error Rate injection acts on the transmitted data.

Type>B2 Byte: The B2 Bytes selection causes inversion of all B2 bytes in the STS-N signal for a duration of one frame. This results in 8 Line Code Violations in an STS-1 signal.

Type>B3 Byte: Selecting B3 Byte results in inversion of the B3 parity byte in the selected STS-1 for a single frame. The path will have 8 Path Code Violations as a result.

Rate> Depending on the error type selected, different choices are available in the Rate> field.

Rate>Single: For Section, Line or Path BER, a single error of the selected type is injected each time the Error Injection button is pressed. For B1, B2, or B3 Byte Inversion, Rate>Single causes an error in one frame of the outgoing SONET signal.

Rate>1.0E-2 to Rate>1.0E-9: For Section, Line or Path BER, a steady error rate of the selected type is started when the Error Injection button is pressed. The errors stop when the button is pressed a second time. The Error Injection Active LED indicator is on while errors are being injected. Error injection can be started before the test is started, ensuring that the steady error rate is active during the entire test.

Rate>Burst: This selection enables control via the rear-panel Burst input. The selected error type will be sent for all valid bit periods when the burst input is at a logic high level. This choice is available for Section, Line and Path BER.

Rate>Off: When the rate is set to Off, the Error Injection button is disabled so the selected error type cannot be inadvertently injected.

VT1.5 Test Configurations

Ins> A DS1 test signal is mapped into one of four possible VT1.5's in a VT Group by selecting VT1.5 Ins>1 to Ins>4.

Other VT's> Selecting Other VT's>Same causes the remaining three VT1.5 channels in the VT Group to be filled with copies of the same DS1 signal. Alternatively, the remaining 3 VT1.5's can be set to Other VT's>Inv for inverted DS1 data, Other VT's>DS1 AIS for DS1 Alarm Indication Signal, or Other VT's>All 0's. It is also possible to put an externally applied DS1 signal into the remaining 3 VT1.5 channels. If Other VT's>Ext is chosen, the external signal is taken from the front panel DS1 Rx port. If Other VT's>Aux is

selected, the external signal is taken from the rear panel auxiliary DS1 input.

Drop> The DS1 to be dropped and tested from a received VT1.5 group can be selected by setting Drop>1 to Drop>4. If Drop>L is selected the drop channel is locked to the insert channel, so that both the insert and drop VT1.5 channels are controlled by the Ins> choice.

VT Group Test Configurations

Ins> Seven VT groups are mapped into one STS-1. Selecting Ins>1 to Ins>7 identifies which one of the seven VT1.5 Groups should be used to transmit the four VT1.5's identified above.

Other Grp's> The remaining six VT Groups can then be made the same as the indicated VT Group by selecting Other Grp's>Same. Alternative settings for the remaining VT Groups are Other Grp's>VT PAIS for VT Path Alarm Indication Signal, or Other Grp's>Unequ to make the other groups unequipped.

Drop> Drop>1 to Drop>7 identifies which of the received VT Groups is to be dropped and tested.

VT1.5 Error Injection

Type> Type>VT BER: VT Bit Error Rate injection causes errors at the selected rate throughout the active VT1.5.

Rate> Depending on the error type selected, different choices are available in the Rate> field.

Rate>Single: For VT BER, a single error is injected each time the Error Injection button is pressed.

Rate>1.0E-2 to Rate>1.0E-9: VT BER, a steady error rate is started when the Error Injection button is pressed. The errors stop when the button is pressed a second time. The Error Injection Active LED indicator is on while errors are being injected. Error injection can be started before the test is started, ensuring that the steady error rate is active during the entire test.

Rate>Burst: This selection enables control via the rear-panel Burst input. The selected error type will be sent for all valid bit periods when the

burst input is at a logic high level. This choice is available for VT BER errors.

Rate>Off: When the rate is set to Off, the Error Injection button is disabled so the selected error type cannot be inadvertently injected.

DS3 Test Configurations

TxClock> Three choices are permitted for the DS3 transmit clock. The TxClock field allows selection of internal clock (TxClock>Int), external clock from the rear panel clock input (TxClock>Ext) or loop timing that derives the clock signal from the received or dropped DS3 input (TxClock>Loop).

If external data is chosen for the transmitted signal (see below), then the transmit clock is determined by the applied external signal, instead of by this configuration selection.

Frm> The DS3 Frame selection field allows the user to select the frame format for the transmitted DS3 signal. When Frm>M13 is selected, standard M13 framing is generated in the transmitted DS3. The framing and control bits for the DS3 signal are as follows.

X1	F1	C11	F0	C12	F0	C13	F1
X2	F1	C21	F0	C22	F0	C23	F1
P1	F1	C31	F0	C32	F0	C33	F1
P2	F1	C41	F0	C42	F0	C43	F1
M0	F1	C51	F0	C52	F0	C53	F1
M1	F1	C61	F0	C62	F0	C63	F1
M0	F1	C71	F0	C72	F0	C73	F1

When transmitting a M13 framed DS3 signal, F1 F0 F1 is a fixed 1001 pattern, and M0 M1 M0 is a fixed 101 pattern. X1 is equal to X2, and the value is user configurable. P1 is equal to P2, and is the parity bit (P-Bit). When the M13 framed signal is made up of DS1/DS2 multiplexed signals the C-Bits control bit stuffing for the DS2 channels. If the M13 framed signal contains a DS3 test pattern a pseudo-random pattern is placed in the C-bits.

When Frm>CBit is selected, C11 is set to zero. C31, C32, and C33 are set equal to each other, and serve as the end-to-end (CP-Bit) parity calculation. In Cbit framed signals generated by the test set, the CP-Bit value is equal to the P-Bit value. C41, C42, and C43 are the FEBC (Far End

Block Error) bits, and are user configurable from 000 to 111 binary). All other C-Bits are set to 1.

When Frm>Unfrm is selected, an unframed DS3 signal is transmitted.

Xbit> Setting XBit>1 or XBit>0 controls the value of both the X1 and X2 bits in the outgoing framed DS3 signal, as described above. For normal operation, the setting should be XBit>1.

FEBE> The 3 bit value to be transmitted in C41, C42, and C43 in a CBit framed signal can be set to any binary value from 000 to 111, for example FEBE>010. For normal operation the setting should be FEBE>111.

Tx> The DS3 Tx port can be set to transmit a DSX3 level signal (Tx>DSX3), a high or low level signal (Tx>High, Tx>Low) or a high level signal built out through 900' of simulated cable (Tx>900'). See Chapter 7 for interface specifications.

Rx> The DS3 Rx port can be configured to receive a DSX3 level signal (Rx>DSX1), a high or low signal, (Tx>High, Tx>Low), or a monitor level signal (Tx>Monitor). See Chapter 7 for interface specifications.

Data> Many choices are available for the data to be transmitted in a DS3 test signal. These are described below.

Data>2¹⁵-1: A 15 stage pseudo-random sequence generator with feedback taps at stages 14 at 15.

Data>2²⁰-1: A 20 stage pseudo-random sequence generator with feedback taps at stages 17 and 20.

Data>2²³-1: A 23 stage pseudo-random sequence generator with feedback taps at stages 18 and 23.

Data>Prog: A user-defined pattern programmable in content and length from 2 to 8 bits. The MSB follows the frame bit for pattern lengths that divide evenly into 84. Programming of the pattern is described in Chapter 5.

Data>AIS: A pattern with valid framing (F and M) bits, all C-bits set to 0, information bits set to a repeating 1010... pattern, and correct parity bits.

Data>All Ones: A framed or unframed all ones pattern. (Framing is controlled by the Frm> selection described above.)

Data>Passthru: The received DS3 signal is passed through to the DS3 Tx port without recomputation of the parity or regeneration of framing. Line-code violations are corrected. This differs from the passthrough used in monitor modes in that errors can be injected on the passthru signal. Note that injection of DS3 Data errors in Passthru will result in parity errors as well.

Data>Idle: A signal valid framing (F and M) bits and an information field set to a repeating 1100... pattern with a 11 after each framing and control bit. C bits are set to 0 in M-subframe 3. The X1 and X2 bits are both set to 1. This data choice over-rides the setting for Frm> described above.

Data>Ext: An external input from the DS3 front panel receive port is used in the outgoing signal. The timing and frame type of the external DS3 signal supersede the configuration settings for TxClk and Frm. This choice is available in modes which transmit the DS3 signal as a payload within a higher-level signal.

Data>Loop: This choice is available in modes which transmit the DS3 signal as a payload within a higher-level signal. The DS3 signal dropped from the higher level signal is used as the outgoing transmitted DS3 signal. The timing and frame type of the dropped DS3 signal supersede the configuration settings for TxClk and Frm.

Data>None: With this selection, (used in monitor mode on circuits with live traffic) the DS3 receiver does not attempt to synchronize on a pattern.

DS3 and DS2 Error Injection

Type> This field selects the type of DS3 errors to be injected. The rate at which the errors are injected is controlled by the Rate> selection, described below. The possible choices for Type> are as follows:

Type>DS3 Data: The DS3 data is errored before the parity is calculated, so parity errors are not generated.

Type>DS3 Dat, Par: DS3 data errors are injected after the parity is calculated, resulting in both data and parity errors.

Type>DS3 BPV: Bipolar violations are injected in the transmitted DS3 signal.

Type>DS3 Frame: This selection causes the F1 and/or F0 frame bits to be errored.

Type>DS3 C1: The C1 bits of the DS3 sub-frames are errored at the selected rate.

Type>DS3 C2: The C2 bits of the DS3 sub-frames are errored at the selected rate.

Type>DS3 C3: The C3 bits of the DS3 sub-frames are errored at the selected rate.

Type>DS3 C ALL: Errors at the selected rate are injected into any or all of the DS3 C-Bits.

Type>DS2 C1: The DS2 C1 bits are errored at the selected rate.

Type>DS2 C2: The DS2 C2 bits are errored at the selected rate.

Type>DS2 C3: The DS2 C3 bits are errored at the selected rate.

Type>DS2 C ALL: Errors at the selected rate are injected into any or all of the DS2 C-Bits.

Rate> Error Rate for each of the error types defined above is selected from the following:

Rate>Single: A single error of the selected type is injected each time the Error Injection button is pressed.

Rate>1.0E-2 to Rate>1.0E-9: A steady error rate of the selected type is started when the Error Injection button is pressed. The errors stop when the button is pressed a second time. The Error Injection Active LED indicator is on while errors are being injected.

Rate>Burst: This selection enables control via the rear-panel Burst input. The selected error type will be sent for all valid bit periods when the burst input is at a logic high level.

Rate>Off: When the rate is set to Off, the Error Injection button is disabled so the selected error type cannot be inadvertently injected.

DS1 Test Configurations

TxCk> Three choices are permitted for the DS1 transmit clock. The TxCk field allows selection of internal clock (TxCk>Int), external clock from the rear panel clock input (TxCk>Ext) or loop timing that derives the clock signal from the received or dropped DS1 input (TxCk>Loop).

If external data is chosen for the transmitted signal (see below), then the transmit clock is determined by the applied external signal, instead of by this configuration selection.

Frm> Depending on the particular mode being run, there can be as many as many as six choices for DS1 framing. Selecting Frm>SF configures the output to conform to the DS1 superframe format, also known as D4 framing. Selecting Frm>ESF configures the signal for extended superframe. Selection of Frm>SF/ESF causes the test set to search the received signal for SF or ESF framing, and configure the transmit framing to match. Selection of Frm>SLC-96 configures the output for SLC-96 framing (also know as TR8). The selection of Frm>MBLT enables a modified SF format used in certain Ericsson switching equipment. This format transmits all ones in the F(s) bits of the SF frame format. This indicates to downstream equipment that DS0 channel 9 is being used for common channel signaling. Finally, Frm>Unfrm is selected to transmit an unframed DS1 signal.

If external data is chosen for the transmitted signal (see below), then the transmit framing type is determined by the applied external signal, instead of by this configuration selection.

If AIS is chosen for the transmitted data (see below), then the transmit signal is unframed regardless of this configuration selection.

- Code> The DS1 line code can be set to either Alternate Mark Inversion (Code>AMI) or Bipolar with 8 Zero Substitution (Code>B8ZS).
- Tx> The DS1 Tx port can be set to transmit a DSX1 level signal (Tx>DSX1) or for Line Build out from the DSX1 level (Tx>LBO -7.5 db, Tx>LBO -15 dB, or Tx>LBO -22 dB). See Chapter 7 for interface specifications.
- Rx> The DS1 Rx port can be configured to receive a DSX1 level signal (Rx>DSX1), for low level monitor applications, (Rx>DSX1 Mon), or for Automatic Line Build-Out (Rx>ALBO). See Chapter 7 for interface specifications.
- Term> The DS1 Rx port can either terminate (Term>Term) or bridge (Term>Bridge) the received signal. See Chapter 7 for interface specifications.
- Data> The selection of data to be transmitted in the DS1 signal is made from many possible choices, depending on the selected mode. These selections are described as follows:

Data>QRSS: A quasi-random pattern composed of a $2^{20}-1$ pattern with a fourteen zero constraint.

Data> 2^6-1 : A 6 stage pseudo-random sequence generator with feedback taps at stages 5 and 6.

Data> 2^9-1 : A 9 stage pseudo-random sequence generator with feedback taps at stages 5 and 9.

Data> $2^{11}-1$: An 11 stage pseudo-random sequence generator with feedback taps at stages 9 and 11.

Data> $2^{15}-1$: A 15 stage pseudo-random sequence generator with feedback taps at stages 14 and 15.

Data> $2^{20}-1$: A 20 stage pseudo-random sequence generator with feedback taps at stages 17 and 20.

Data> $2^{23}-1$: A 23 stage pseudo-random sequence generator with feedback taps at stages 18 and 23.

Data>All Ones: This selection causes the data field to be filled with ones.

Data>3 in 24: This fills the data field with a 12.5% ones density pattern synchronized to the F-bit position as follows:

F10100010000000000000000100.

Data>Progr #n: Selecting a value from 1 to six will transmit a user-defined pattern programmable in content and length from 2 to 24 bits. The MSB follows the frame bit for pattern lengths that divide evenly into 192. Programming of the actual patterns is described in Chapter 5.

Data>AIS: This causes the transmission of an all ones unframed signal. Note that selection of this data pattern over-rides the transmit framing selection.

Data>Ext: An external input from the front panel DS1 Receive connector is used as the transmit signal. The received timing and frame type supersede the configuration settings for TxClk and Frm. This choice is available in modes which transmit the DS1 signal as a payload within a higher-level signal.

Data>Passthru: The received DS1 signal is passed through to the DS1 Tx port without recomputation of the CRC-6 or regeneration of framing. Line-code violations are corrected. This differs from the passthrough used in monitor modes in that errors can be injected on the passthru signal. Note that injection of DS1 Data errors in Passthru will result in CRC errors as well.

Data>None: With this selection, (used in DS1 or DS3/DS1 monitor operation on circuits with live traffic) the DS1 receiver does not attempt to synchronize on a pattern.

Data>LoopUp n: This selection causes one of two different programmable loopup patterns to be transmitted. One of the patterns is used for Network Interface Units and the other is used for Channel Service Units. These units respond to the loopup patterns by switching to loopback operation. If effective, the loopup patterns will be transmitted back to the Series 31XE within five seconds as the equipment under test responds by going into a loopback configuration. The loopup pattern will be transmitted continuously for the duration of the test. The procedure for programming the loopup patterns is defined in Chapter 5.

Data>Loopdown n: This selection causes one of two different programmable loopdown patterns to be transmitted. One of the patterns is used for Network Interface Units and the other is used for Channel Service Units. These units respond to the

loopdown patterns by switching out of loopback operation. If effective, the Series 31XE receiver will lose the loopdown pattern within five seconds when the equipment under test goes out of loopback. The loopdown pattern will be transmitted continuously for the duration of the test. The procedure for programming the loopdown patterns is defined in Chapter 5.

Data>55 Octet: This is also known as the Daly pattern. When transmitted with framing, the frame bit is inserted at octet boundaries and no pattern bits are overwritten. The pattern is as follows:

```

10000000 10000000 10000000 10000000 10000000
10000000 00000001 10000000 10000000 10000000
10000000 10000000 10000000 11000000 10000000
10000000 10000000 10000000 11100000 10000000
10000000 10000000 10000000 10101010 10101010
10101010 10101010 01010101 01010101 01010101
01010101 10000000 10000000 10000000 10000000
10000000 10000000 11111111 11111111 11111111
11111111 11111111 11111111 00000001 10000000
00000001 10000000 00000001 10000000 00000001
10000000 00000001 10000000 00000001 10000000

```

- Ins> This selection is used in modes which generate a DS3 signal containing M13 mapped DS1's. The choice determines which channel (1-28) in the outgoing DS3 signal will contain the signal defined above, for example Ins>2 or Ins>25.
- Other> This field allows the remaining DS1 channels to be the same as the inserted channel (Other>Same), or to be the Inverse of the inserted channel but with upright framing (Other>Inv). Alternatively an all ones AIS signal can be used to fill the signal (Other>AIS).
- Drop> The drop selection determines which of the 28 channels in a received DS3 signal will be measured and/or sent to the DS1 drop port, for example Drop>1 or Drop>17. Alternatively, the drop channel selection can be locked to the insert channel number. This is done by selecting Drop>L. When locked, the dropped DS1 channel number is always the same as the inserted DS1 number.
- D&I> For DS1 Drop and Insert modes, selecting D&I>1 to D&I>28 identifies the DS1 channel to be dropped and replaced.

DS1 Error/Alarm Injection

Type> This field selects the type of DS1 errors to be injected. The rate at which the errors are injected is controlled by the Rate> selection, described below. The possible choices for Type> are as follows:

Type>DS1 Data: Data errors cause the signal to be errored prior to calculation of the CRC.

Type>DS1 Dat,CRC: For combined Data and CRC errors, the signal is errored after calculation of the CRC.

Type>DS1 Frame: Selection of DS1 Frame errors causes the frame bits to be errored. If either SF or SLC-96 framing is selected, the FT bits are errored. The FPS bits are errored when ESF framing is in use.

Type>DS1 BPV: DS1 BPV selection causes bipolar violations to be inserted in the DS1 data. When using B8ZS coding, BPV's will cause data errors as well.

Type>Yellow Alm: Yellow alarm is asserted in the outgoing DS1 signal, using DS0 bit 2 in SF framed modes, or an alternating 00 FF (hex) pattern in the facility data link for ESF modes.

Rate> Error Rate for each of the error types defined above is selected from the following:

Rate>Single: A single error of the selected type is injected each time the Error Injection button is pressed.

Rate>1.0E-2 to Rate>1.0E-9: A steady error rate of the selected type is started when the Error Injection button is pressed. The errors stop when the button is pressed a second time. The Error Injection Active LED indicator is on while errors are being injected.

Rate>Burst: This selection enables control via the rear-panel Burst input. The selected error type will be sent for all valid bit periods when the burst input is at a logic high level.

Rate>Continuous: This choice is used for yellow alarm injection. When selected, the Error Injection button toggles the alarm condition on and off.

Rate>Off: When the rate is set to Off, the Error Injection button is disabled so the selected error type cannot be inadvertently injected.

DS0 Test Configurations

Ins> Determines which DS0 channel, Ins>1 to Ins>24 will be used for transmission of the test tone or external VF signal.

Other> The remaining DS0 channels can be set the same (Other>Same) as the Ins> channel, or can be set to all ones (Other>All Ones).

Drop> Allows selection of the DS0 channel to drop and measure, (Drop>1 to Drop>24).

D&I> For DS0 drop and insert modes, identifies the channel (D&I>1 to D&I>24) to be dropped and replaced.

Port> Selecting Port>Drop Ch sends the dropped VF to the rear-panel drop port. Selecting Drop> Data Link sends the ESF facility data link to the rear-panel port.

Tone> The transmitted timeslot signal can be set to one of three Digital Reference Signals: Tone>DRS 1004 Hz, Tone>DRS 1012 Hz, or for external VF insert (Tone> External VF). E1 Test Configurations

TxClk> Three choices are permitted for the DS1 transmit clock. The TxClk field allows selection of internal clock (TxClk>Int), external clock from the rear panel (DS1) clock input (TxClk>Ext) or loop timing that derives the clock signal from the received or dropped DS1 input (TxClk>Loop).

If external data is chosen for the transmitted signal (see below), then the transmit clock is determined by the applied external signal, instead of by this configuration selection.

Frm> There are five six choices for E1 framing. Selecting Frm>TS0 configures the output to conform to the E1 Time-Slot Zero framing format, with no CRC calculations. Selecting Frm>TS0+CRC configures

the signal for TS0 framing plus CRC-4. Selection of `Frm>TS0+TS16` results in Timeslot 0 and 16 framing without CRC calculation. Selection of `Frm>TS0+TS16+CRC` configures the output for TS0 and TS16 framing, with CRC-4. Finally, `Frm>Unfrm` is selected to transmit an unframed E1 signal.

If AIS is chosen for the transmitted data (see below), then the transmit signal is unframed regardless of this configuration selection.

- `Code>` The E1 line code can be set to either Alternate Mark Inversion (`Code>AMI`) or High Density Bipolar of order 3 (`Code>HDB3`).
- `Rx>` The E1 Rx port can be configured to receive a DSX level signal (`Rx>DSX`), or for low level monitor applications, (`Rx>Monitor`). See Chapter 7 for interface specifications.
- `Term>` The E1 Rx port can either terminate (`Term>Term`) or bridge (`Term>Bridge`) the received signal. See Chapter 7 for interface specifications.
- `Data>` The selection of data to be transmitted in the E1 signal is made from many possible choices, depending on the selected mode. These selections are described as follows:

`Data>QRSS`: A quasi-random pattern composed of a $2^{20}-1$ pattern with a fourteen zero constraint.

`Data>2^6-1`: A 6 stage pseudo-random sequence generator with feedback taps at stages 5 and 6.

`Data>2^9-1`: A 9 stage pseudo-random sequence generator with feedback taps at stages 5 and 9.

`Data>2^11-1`: An 11 stage pseudo-random sequence generator with feedback taps at stages 9 and 11.

`Data>2^15-1`: A 15 stage pseudo-random sequence generator with feedback taps at stages 14 and 15.

`Data>2^20-1`: A 20 stage pseudo-random sequence generator with feedback taps at stages 17 and 20.

`Data>2^23-1`: A 23 stage pseudo-random sequence generator with feedback taps at stages 18 and 23.

`Data>All Ones`: This selection causes the data field to be filled with ones.

Data>3 in 24: This fills the data field with a 12.5% ones density pattern synchronized to the F-bit position as follows:
F10100010000000000000000100.

Data>Progr #n: Selecting a value from 1 to six will transmit a user-defined pattern programmable in content and length from 2 to 24 bits. Programming of the actual patterns is described in Chapter 5.

Data>AIS: This causes the transmission of an all ones unframed signal. Note that selection of this data pattern over-rides the transmit framing selection.

Data>None: With this selection, (used in E1 monitor operation on circuits with live traffic) the E1 receiver does not attempt to synchronize on a pattern.

Data>55 Octet: This is also known as the Daly pattern. The pattern is as follows:

```
10000000 10000000 10000000 10000000 10000000
10000000 00000001 10000000 10000000 10000000
10000000 10000000 10000000 11000000 10000000
10000000 10000000 10000000 11100000 10000000
10000000 10000000 10000000 10101010 10101010
10101010 10101010 01010101 01010101 01010101
01010101 10000000 10000000 10000000 10000000
10000000 10000000 11111111 11111111 11111111
11111111 11111111 11111111 00000001 10000000
00000001 10000000 00000001 10000000 00000001
10000000 00000001 10000000 00000001 10000000
```

E1 Error/Alarm Injection

Type> This field selects the type of E1 errors to be injected. The rate at which the errors are injected is controlled by the Rate> selection, described below. The possible choices for Type> are as follows:

Type>E1 BPV: E1 BPV selection causes bipolar violations to be inserted in the E1 data.

Type>E1 Data: Data errors cause the signal to be errored prior to calculation of the CRC.

Type>E1 Data,CRC: For combined Data and CRC errors, the signal is errored after calculation of the CRC.

Type>E1 Frame: Selection of E1 Frame errors causes the frame pattern in time slot zero to be errored. CRC errors are not generated.

Type>E1 Frm,CRC: Selection of E1 Frm,CRC errors causes the frame pattern in time slot zero to be errored, accompanied by CRC errors.

Type>E1 MFrame: Selection of E1 MFrame errors causes the time slot 16 frame 0 to be errored. CRC errors are not generated.

Type>E1 MFrame: Selection of E1 MFrame errors causes the time slot 16 frame 0 to be errored, accompanied by CRC errors.

Type>Remote Alm: Yellow Alarm, or Remote Alarm is asserted by setting bit 3 of received timeslot 0 = 1.

Type>MltiFrm Alm: Distant Multiframe Alarm is asserted by setting bit 6, frame 0, of timeslot 16 = 1.

- Rate> Error Rate for each of the error types defined above is selected from the following:
- Rate>Single: A single error of the selected type is injected each time the Error Injection button is pressed.
- Rate>1.0E-2 to Rate>1.0E-9: A steady error rate of the selected type is started when the Error Injection button is pressed. The errors stop when the button is pressed a second time. The Error Injection Active LED indicator is on while errors are being injected.
- Rate>Burst: This selection enables control via the rear-panel Burst input. The selected error type will be sent for all valid bit periods when the burst input is at a logic high level.
- Rate>Continuous: This choice is used for alarm injection. When selected, the Error Injection button toggles the alarm condition on and off.
- Rate>Off: When the rate is set to Off, the Error Injection button is disabled so the selected error type cannot be inadvertently injected.

E1 Timeslot Test Configurations

- Ins> Determines which timeslot, Ins>2 to Ins>31 will be used for transmission of the test tone or external VF signal. (The user is allowed to overwrite timeslot 16, even if TS16 framing is selected.)
- Other> The remaining E1 timeslots can be set the same (Other>Same) as the Ins> timeslot, or can be set to all ones (Other>All Ones). When TS16 framing is selected, the Other> choice will not overwrite timeslot 16.
- Drop> Allows selection of the timeslot to drop and measure, (Drop>2 to Drop>31).
- D&I> For timeslot drop and insert modes, identifies the channel (D&I>2 to D&I>31) to be dropped and replaced.
- Signal Bits> This allows selection of signalling bits externally inserted (Signal Bits>Ext) or internally controlled (Signal Bits>Int).

- A> The transmitted A signalling bit can be programmed to A>0 or A>1.
- B> The transmitted A signalling bit can be programmed to B>0 or B>1.
- C> The transmitted A signalling bit can be programmed to C>0 or C>1.
- D> The transmitted A signalling bit can be programmed to D>0 or D>1.
- Tone> The transmitted timeslot signal can be set to one of three Digital Reference Signals: Tone>DRS 1004 Hz, Tone>DRS 1012 Hz, or for external VF insert (Tone> External VF).

Alternate Configuration Screens

The screens defined in this section each occupy the lower 6 lines of the display, and are accessed by pressing the ENTER key again after entering a test mode. When ENTER is pressed, an alternative configuration screen replaces the mode's native configuration screen. In fact, repeatedly pressing the ENTER key accesses an ordered cycle of four configuration screens, as detailed below::

- 1) Mode Configuration screen (specific to the chosen mode.)
- 2) Global Configurations screen (always available)
- 3) SONET Alarm screen (available for Terminal and D&I modes using STS-1 Tx Rate)
- 4) K1,K2 APS configuration screen (available Terminal and D&I modes using STS-1 Tx Rate)

Each of these alternative configuration screens is described below.

Global Configurations Screen

The Global Configurations Screen is shown below (occupying the lower six lines of the screen).

```
>Modify Global Configurations<
Modify Config While Running? No
Results Level: 4
Inhibit Errors on Alarm? Yes
BITS Clk Out Derived from: STS-N Rx Clk
```

Modify Config While Running? This parameter can be set to No or Yes. Selecting No causes the FIELD cursor to disappear while a test is running. This prevents modification of configurations during a test. Selecting "Yes" allows setups to be changed dynamically during testing.

Results Level: The Results Level can be set to 1,2,3, or 4. Setting the Results Level to 1 limits the display of results to summary screens. Results Level 2 and 3 add more detail. Results Level 4 displays all summary and detailed screens, including all SONET overhead measurements.

Inhibit Errors on Alarm? This selection can be set to Yes or No. When set to Yes, error counting is inhibited during alarm conditions. It should be set to No for special applications such as measuring protection switching time through observation of Bit Error Output signals.

BITS Clk Out Derived from: STS-N Rx Clk or STS-N Tx Clk
This setting controls the optional BITS Clk Output signal. When set to STS-N Rx Clk, the BITS output reference is derived from the incoming SONET signal. This mimics the behavior of the BITS outputs on SONET terminal equipment. When set to STS-N Tx Clk, the BITS output is derived from whichever TxClk timing source has been selected within the test mode. This allows the BITS output to be derived from the incoming BITS input, or from the internal Stratum III clock.

SONET Alarm Screen

The SONET alarm screen allows multiple alarm conditions to be set simultaneously. LOS, LOF, LAIS, LFERF, STS LOPNTR, PAIS, PYEL, VT PAIS, VT PYEL, and VTLOPNTR can each be turned on and off independently from this screen using the FIELD and VALUE buttons. In addition, the error type and rate can still be set from the Mode Configuration Screen. This means that a particular selected error type and rate can be running concurrently with the simultaneous alarms.

The SONET Alarm screen, which occupies the lower six lines of the display, is shown below.

```
>Set SONET Alarms Conditions<
  LOS>Off          STS PAIS>Off
  LOF>Off          STS PYEL>Off
  LAIS>Off         VT PAIS>Off
  LFERF>Off        VT PYEL>Off
  STS LOPNTR>Off   VT LOPNTR>Off
```

By allowing simultaneous alarm generation, the Series 31XE can simulate network conditions where multiple prioritized alarms may be present at a given time. In most cases, the alarms will naturally take their own priority. For example, a simultaneous LOS and LAIS will actually be an LOS. Removal of the LOS will leave the LAIS in place, unless it is specifically removed.

However, in the case of LAIS and LFERF, which use the same 3-bit code space in the K2 byte, the test set artificially forces the priority. If these two alarms are ever both selected simultaneously, the LAIS is sent. If the LAIS is turned off before the LFERF, then the LFERF replaces the LAIS. This transition occurs in a single frame.

The alarms are controlled directly by the FIELD and VALUE keys. The Error Injection Key is not used.

Note that this screen is the only screen where LAIS or LFERF can be set. The K1,K2 APS screen defined in the next section does not allow setting the LAIS or LFERF codes.

K1,K2 APS Screen

This screen allows the user to select and send APS messages over the K1,K2 bytes without stopping execution of a test. In addition, it allows the K1,K2 bytes to be programmed according to the english-language message to be transmitted. The user doesn't have to know the binary or hex codes in order to program the K1,K2 bytes. This screen, when used in conjunction with the APS Measurements screen provides a powerful interactive APS test capability.

In order to run an APS test interactively, the test set must send one K1,K2 message continuously, then immediately switch to a new message. For this to occur, the user is given the ability to set up the desired new message, and then to "UPDATE" the current message to reflect the desired new settings. The K1,K2 APS Screen, which uses the lower six lines of the display, is shown below.

```
>Press Error Inject to Update K1,K2<
New Values      |      Current Values
K1:00 K2:00 (Hex) | K1:00 K2:00 (Hex)
No Request      |      No Request
Rqst>Null Brdg>Null | Rqst:Null Brdg:Null
1+1 Future (000) | 1+1 Future (000)
```

The messages currently being transmitted in the K1,K2 bytes are displayed in the right-hand section of the screen. The left half of the screen is used to set up the next desired messages to transmit. In addition, the hex value of both the new and current K1,K2 values are shown. As the user selects new messages to send, the "new" K1,K2 bytes update dynamically on the configuration screen.

When the user is satisfied that the messages prepared on the left half of the screen are correct, the Error Inject button can be pressed, immediately updating the transmitted message. The right half of the screen will also update to reflect this change.

The message "No Request" shown on the screen corresponds to a binary value of 0000 being sent in bits 1-4 of byte K1. The messages which can be selected in this field are shown below, along with the corresponding binary K1 values:

<u>Message</u>	<u>K1, Bits 1-4</u>
No Request	0000
Do Not Revert	0001
Reverse Request	0010
Not Used (0011)	0011
Exercise	0110
Not Used (0101)	0101
Wait-to-restore	0110
Not Used (0111)	0111
Manual Switch	1000
Not Used (1001)	1001
SD-Low Priority	1010
SD-High Priority	1011
SF-Low Priority	1100
SF-High Priority	1101
Forced Switch	1110
Lockout Protect	1111

The value selected for Rqst> indicates the requested channel, as specified by K1 Bits 5-8. Null corresponds to a value of zero in these bits, while values from 1 to 15 indicate transmission of the corresponding binary numbers, 0001 to 1111.

	<u>K1, Bits 5-8</u>
Rqst>Null	0000
1 to 15	0001 to 1111 binary

The value selected for Brdg> indicates the bridged channel, as specified by K1 Bits 5-8. Null corresponds to a value of zero in these bits, while values from 1 to 15 indicate transmission of the corresponding binary numbers, 0001 to 1111.

K2, Bits 1-4

Brdg>Null	0000
01 to 15	0001 to 1111 binary

The indication 1+1 above can alternatively be set to 1:n, with the appropriate affect on the outgoing K2 bit 5.

K2, Bit 5

1+1	0
1:n	1

Finally, the indication "Future (000)" shown on the screen above reflects the value of the outgoing K2, bits 6-8. The messages which can be selected and the corresponding values of the K2 bits are shown below.

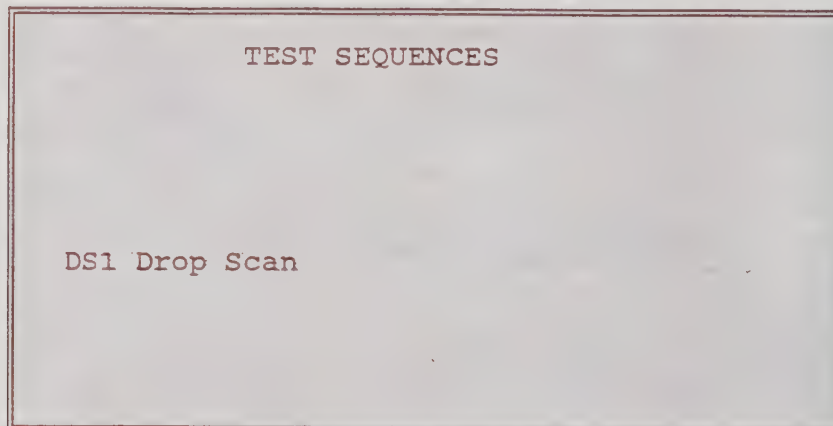
K2, Bits 6-8

Unidirection	100
Bidirection	101
Future (000)	000
Future (001)	001
Future (010)	010
Future (011)	011
LFERF Alarm	110
LAIS Alarm	111

Note: Codes 110 and 111 cannot be set from this screen, but the LFERF or LAIS message will be displayed the alarm condition is set from the SONET Alarm screen described earlier in this chapter.

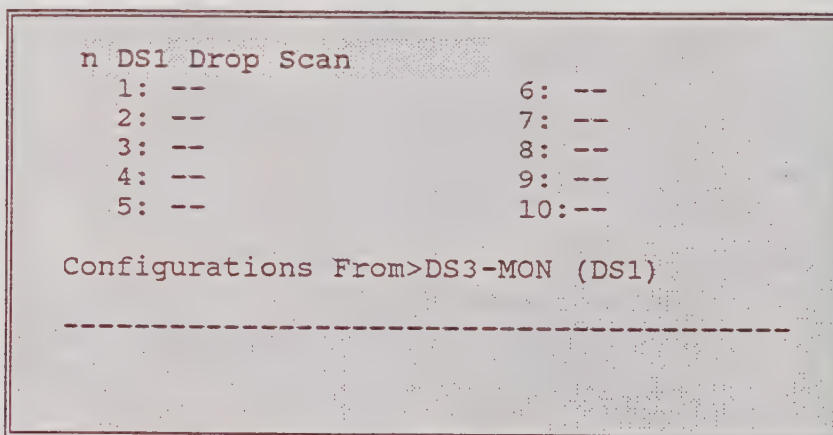
MAIN MENU SELECTION: Sequences

Preprogrammed test sequences are provided to perform specialized tests. The Sequences menu currently has one selection.



DS1 Drop Scan Sequence

The DS1 drop scan sequence measures each of the 28 DS1 channels in a DS3 signal one at a time. The DS3 can be an electrical signal at the DS3 Rx connector, or it can be dropped from an STS-1 signal.



A series of tests is made on each DS1 channel within the DS3, resulting in the following possible result messages:

NO SIGNAL Lack of signal on the DS3 or DS1 input.

AIS A DS1 AIS pattern has been detected.

NO FRAME The DS1 framing type as selected in the background mode has not been detected.

FRAME DS1 frame synchronization has been detected without pattern synchronization. The framing format detected is as selected in the background mode.

FRM & PAT Both DS1 framing and pattern synchronization (as selected in the background mode) have been detected.

A test is made for each result condition in the order shown above. The first valid result detected for each channel is displayed.

The Configurations From> field determines the test configurations and the source of the DS3 signal to be scanned. The configurations last set for this mode are used during the test sequence. The START button is used to start the scan. After all 28 DS1's have been scanned once, the sequence terminates. Results are accessed by pressing the RESULTS buttons. The background modes available for selection are given below.

Configurations From>DS3-MON (DS1)
DS3-DS3 (DS1)
STS1-MON (DS3/1)

Chapter 5: Using Special Features

Chapter 4 described the use of the first four choices on the Series 31XE Main Menu. This chapter discusses the remaining three Main Menu selections.

MAIN MENU

Terminal (Independent Tx and Rx)
Monitor (Non-disruptive pass-through)
D&I (Payload Drop & Insert)
Sequences (Programmed test sequences)
Patterns (Programmable data patterns)
Setup (System parameters)
Configure (Store/Recall configurations)

Press PREV FIELD/NEXT FIELD to select.
Press ENTER for next level of selection.

MAIN MENU SELECTION: Patterns

This menu selection is used in conjunction with many of the other testing modes. Tests that employ data patterns, overhead patterns and loop-up/loop-down codes use information specified here. Information is supplied by the user in a variety of formats including ASCII, binary and hexadecimal depending upon the particular pattern or parameter being programmed. Information is changed from default values by using the same combination of FIELD and VALUE pushbuttons as in other menus.

When the Patterns selection is made from the Main Menu, the Programmable Patterns menu is displayed.

PROGRAMMABLE PATTERNS

STS1 Transport Overhead Configuration
STS1 Path Overhead Configuration
STS1 Path Trace Bytes 1-32
STS1 Path Trace Bytes 33-64
DS1 Data Patterns
DS3 Data Pattern and DS1 Loop Codes

Press PREV FIELD/NEXT FIELD to select.
Press ENTER to enter mode.

STS1 Transport Overhead Configuration

The Transport Overhead Configuration screen allows configuration of the C1 and F1 section overhead bytes. (See Alternate Configuration Screens in Chapter 4 for information on setting the K1 and K2 bytes.)

STS-1 Transport OH Set-up

C1 Mode: Normal

C1 #1 (bits 3-0): 0000

F1: 00

C1 Mode: If C1 Mode: Normal or C1 Mode: NTT is selected, C1 is set to 00000001. If C1 Mode: Test is selected, the value specified below is placed in C1 bits 1 to 4.

C1: The four low bits of C1 can be programmed. This value is used when C1 Mode is set to Test.

F1: F1, the section user channel, is programmed on the transmit side. The value is programmed in hexadecimal.

STS-1 Path Overhead Configuration

The STS-1 Path Overhead Set-up screen allows the user to program the path overhead byte values for the transmitted SONET signal.

STS-1 Path Overhead Set-up	
C2: 00	Z3: 00
F2: 00	Z4: 00
	Z5: 00
O-Bit:	000000000000000000

C2: C2, the STS-1 path signal label, can be programmed in hexadecimal.

F2: The path user channel, F2, can be programmed in hexadecimal.

Z3,Z4,Z5: The path growth bytes, Z3 through Z5 can be programmed in hexadecimal.

O-Bit: In the format for mapping a DS3 signal into an STS-1, 18 bits are reserved as "Overhead Bits". These bits can be programmed here in binary form.

Path Trace Bytes 1 - 32, and 33 - 64

The J1 byte in the path overhead is called the path trace. The SONET standard specifies that a repeating 64 byte pattern can be transmitted in J1, to identify the Central Office from which the SONET signal originates. Two screens allow the user to program this 64 byte pattern. The first screen is for programming the first 32 bytes of the sequence. The second screen programs the second half of the sequence.

STS-1 Path Trace Bytes (J1) 1-32 Setup

1:	00	00	00	00	00	00	00	00	-----
9:	00	00	00	00	00	00	00	00	-----
17:	00	00	00	00	00	00	00	00	-----
25:	00	00	00	00	00	00	00	00	-----

STS-1 Path Trace Bytes (J1) 33-64 Setup

33:	00	00	00	00	00	00	00	00	-----
41:	00	00	00	00	00	00	00	00	-----
49:	00	00	00	00	00	00	00	00	-----
57:	00	00	00	00	00	00	00	00	-----

Each byte of the sequence is programmed in hexadecimal on the left side of the display. If the hexadecimal code programmed into any byte corresponds to a printable ASCII character, that character is displayed in the appropriate position on the right side of the display. If the code does not correspond to a printable ASCII character, then a dash is displayed on the right side of the screen.

DS1 Data Patterns

Six programmable DS1 patterns are available. Each one can be from 2 to 24 bits.

DS1 Programmable Patterns 1-6

```
DS1 Prog Pat 1: 01000000.....
DS1 Prog Pat 2: 010000.....
DS1 Prog Pat 3: 01000100000.....
DS1 Prog Pat 4: 0100010000000000.....
DS1 Prog Pat 5: 0100010000000000100.....
DS1 Prog Pat 6: 0100010000000000000100...
```

Each bit can be set to 0 or 1. To shorten the pattern, unused bit positions to the right of the pattern are set to '.' indicating NULL.

DS3 Data Pattern & DS1 Loop Codes

One 2-8 bit programmable DS3 pattern is available. Two DS1 loop-up and two DS1 loop-down sequences are also available, each programmable from 2 to 24 bits.

The loop-up and loop-down codes are used to signal Network Interface Units and Channel Service Units to configure themselves in and out of a loopback condition. The default codes (shown above) can be modified to control non-standard equipment or to insure that standard equipment operates and responds properly to the commands.

DS3 Prog Pattern and DS1 Loop Patterns

```
DS3 Prog Pat: 10101010

DS1 Loop Up 1: 1000.....
DS1 Loop Up 2: 11000.....
DS1 Loop Dn 1: 100.....
```

Each bit can be set to 0 or 1. To shorten the pattern, unused bit positions to the right of the pattern are set to '.' indicating NULL.

MAIN MENU SELECTION: Setup

The SETUP menu provides access to three different setup screens, including the optional Event Logging Setups.

```

                                SETUP

Global Test Setups
Administrative Setups
Event Logging Setups

-----
Press PREV FIELD/NEXT FIELD to select.
Press ENTER to enter Setup Screen

```

Global Test Setups

The Global Test Setups screen affects the timing of each test as well as controlling printer and memory operations. The Setup Menu has five different configuration fields that may be adjusted by the user.

```

Global Test Setups

Test Dur. Mode:    Continuous
Timer Duration:    00:01:00 (hh:mm:ss)
Auto. Print Mode:  Off
Auto. Store Mode:  Off

Version:           X.XX

```

Test Dur. Mode: Test Duration Mode controls how each test is started and stopped as well as affecting print and store functions.

Choosing Test Dur. Mode: Continuous allows manual control of the Series 31XE operation from the front panel. Start and Stop pushbuttons control testing while Print Control and Store control printing and memory storage, respectively.

If Test Dur. Mode: Timer is selected, the user can start the test from the front panel Start pushbutton. The test completes when the amount of time defined in the timer duration field (discussed below) is reached. Upon completion, test results may be stored in the next available memory buffer or printed.

A more automated control mode is available by selecting **Test Dur. Mode: Timer/Restart**. With this selection, a test that has been started with the front panel Start pushbutton will continue until the time set in the timer duration field (discussed below) has elapsed. At that time, three different events can occur:

1. The test results may be stored in the next available memory buffer (depending on the setting for Auto Store Mode).
2. The results may be sent to the printer for printing (depending on the setting for Auto Print Mode).
3. The test is automatically restarted after the results are cleared to zero.

Timer Duration: This field is used when the Test Duration Mode is set to Timer or Timer/Restart. The desired test time is set in Hour:Minute:Second format.

Auto Print Mode: The Auto Print Mode setting determines when and if test results will be automatically sent to the printer. If **Auto Print Mode: Off** is selected, results will only be printed when the front panel Print Control is pressed.

If the user selects **Auto Print Mode: Timed Test End**, results will be sent upon test completion when Timer or Timer Restart is selected for Test Duration Mode. Alternatively, even with any of the three Test Modes (Continuous, Timer or Timer/Restart), the Series 31XE can be programmed to print all results each time an error occurs.

This is done by selecting Auto Print Mode: On Error.

The last two selections for Auto Print Mode are used for long term testing or equipment monitoring. By choosing Auto Print Mode: Every 15 Minutes or Auto Print Mode: Every 2 Hours the Series 31XE can send test results to the printer at fixed intervals during a test.

Note: for additional automatic printing capabilities, see the optional Event Logging feature, described in a later section.

Auto Store Mode: This field controls automatic storage of test results into the 12 storage buffers. The choices for Auto Store Mode are the same as those described above for Auto Print Mode. These choices are Auto Store Mode: Off, Timed Test End, On Error, Every 15 Minutes, and Every 2 Hours.

Storage can also be controlled directly by the front panel STORE button. When test results are sent to memory storage, the Series 31XE deposits the results in the next available buffer. (The next available buffer indicator is shown in the upper left corner of each display screen.) Once the last buffer, buffer twelve, has been written, additional results will be stored in buffer number one and will overwrite whatever results had previously been stored. Before starting a test, the user should observe the buffer number indicator and determine whether buffers need to be printed, cleared or safely overwritten.

Version: The global setup menu also displays the current software version. This field is not user-configurable but will change when new revisions of the operating software are loaded.

Administrative Setups

The Administrative Setups screen controls factors which don't directly impact testing.

Administrative Setups	
Printer:	9600,8-1-None
Remote:	9600,8-1-None
Date & Time:	dd/mm/yy hh/mm/ss
GPIB Addr:	29
GPIB Via:	IEEE-488

Printer: The RS-232 printer port can be configured for baud rate, number of data bits, number of start bits, and parity type, in that order. The default settings are Printer: 9600,8-1-None. The baud rate may be selected from 9600, 300, 1200, 2400, or 4800. Data bits can be set to 8 or 7. Start Bits can be 1 or 2. Parity can be set to None, Even, or Odd.

Remote: The possible settings for the Remote RS-232 port are identical to those for Printer, above.

Date & Time: The Series 31XE maintains a battery backed-up clock calendar that maintains current time and date. If it becomes necessary to change the settings, the Date & Time can be adjusted using the Field and Value pushbuttons.

GPIB Addr: If the GPIB (IEEE-488 Instrument Bus) option has been installed, the address value, from 1 to 30 is selected in the GPIB Addr field.

GPIB Via: GPIB communication can be directed over the IEEE-488 bus by selecting GPIB Via: IEEE-488. Alternatively, the commands and responses can use the RS-232, by selecting GPIB Via: RS-232. Note that when RS-232 is selected for the GPIB interface, the optional remote front panel is disabled.

Event Logging Setups

The Data/Event Logging option monitors error and alarm conditions. Using a variety of user-selectable criteria, this option captures and displays report messages in an event log. Report messages include the date and time, and the nature of the alarm or error occurrence. Up to fifty of these messages are stored and can be displayed to give the user a profile or history of events. The event messages can also be output to the printer port if selected.

Events are defined as the occurrence or clearing of alarms, the removal or restoration of power to the test set during a test, or the occurrence of selected errors. Selectable error types include bit, framing, CRC/Parity and Bipolar violations for DS1, DS3 or STS-1 signals.

The Data-event logging screen is shown below.

n Event Log

Event Print: No

	DS1	DS3	SONET
Bit	: Don't Log	Don't Log	
Frame	: Don't Log	Don't Log	Don't Log
CRC/P/BIP	: Don't Log	Don't Log	Don't Log
BPV	: Don't Log	Don't Log	Don't Log

Event Print: Selecting Event Print: Yes causes each event message to be sent to the printer as it occurs. This creates an unlimited length printed log of alarm and error events. The printer can be turned off by selecting Event Print: Off.

The user can select Don't Log or Log All for any error type. Log All will result in a message for every second during which there was an error occurrence of the identified type.

To conserve buffer space and/or printer paper, the user can select error thresholds for squelching error reports. The squelch level can be set from Occurrence E-3 to Occurrence E-6. After 10 consecutive errored seconds are reported with an error rate at or above the specified squelch rate, the message "...Squelch On" is logged. No subsequent logging for the squelched error type will occur

until 5 consecutive seconds are detected with an error rate below the squelch rate. At this time the message "...Squelch Off" is logged.

Each report message occupies a single line in the top half of the LCD screen, and includes Day, Month, Hour, Minute, Second, and the alarm or error event which occurred. Although there may be up to 50 different events logged, only 5 are visible on the screen at a time. The Results pushbuttons may be used to cycle back and forth through the 10 possible results displays.

MAIN MENU SELECTION: Configure

The Store/Recall Configurations screen allows users to save setups for commonly used tests. When a test is stored, the following information is saved in one of ten available buffers:

The mode or sequence most recently exited is stored (even if a test had not been run in that mode), along with all the configurations for that mode. Results are not stored.

Test-wide parameters are also stored. These include all information set up via the Programmable Patterns screen; all information set up via the Global Test Setups screen; all information set up via the Administrative Setup screen (except Date & Time); and all information set up via the Event Logging Setups screen.

When a Recall is executed, the information listed above is retrieved. This data becomes the current operating data, and the screen is immediately shifted to the recalled mode screen, with the recalled configurations already selected.

The configuration information is stored in buffers that are retained by a battery backed-up memory.

STORE/RECALL CONFIGURATIONS	#	Status
	1	>DS3-MON (DS3)
Action: Recall	2	EMPTY
	3	EMPTY
Test #: 1	4	EMPTY
03/13/93 16:59:38	5	EMPTY
-----	6	EMPTY
Press ENTER to	7	EMPTY
initiate action.	8	EMPTY
Press MENU to go	9	EMPTY
to Main Menu.	10	EMPTY

Note: The right-arrow symbol shown next to buffer 1 above, moves according to the Test # selected.

Action: When Action: Store is selected, pressing the ENTER button causes the current test set state to be stored in the selected buffer. If this field is set to Action: Recall, then pressing ENTER will recall the test set state as previously stored in the selected buffer, and immediately jump to that mode or sequence screen. If Action: Clear is chosen, the selected buffer is cleared when the ENTER button is pressed.

Test #: Selecting Test #: 1 to Test #: 10 identifies the buffer to be stored, recalled, or cleared. The right-arrow symbol shown above next to buffer 1 moves to correspond with the selected Test #.

These are the only two user configurable fields on the screen. Just below the Test # field is a display of date and time. This is the time at which the currently selected Test # was stored. If the selected buffer is EMPTY, this line is blank.

The right half of the screen shows the status of each of the 10 available storage buffers. The example screen shown above has a test stored in buffer 1, with the remaining buffers EMPTY. The test stored in this example used DS3-MON (DS3) mode, and was stored on February 13, 1993 at 4:59 PM.

To prevent inadvertent erasure of stored test configurations, warning messages are displayed in the lower left-hand corner of the display before certain actions are executed,

If a store is requested into a non-empty buffer, the following message is displayed:

STORE/RECALL CONFIGURATIONS	#	Status
	1>	DS3-MON (DS3)
Action: Store	2	EMPTY
	3	EMPTY
Test #: 1	4	EMPTY
03/13/93 16:59:38	5	EMPTY
-----	6	EMPTY
Overwrite the	7	EMPTY
buffer?	8	EMPTY
Press MENU for YES	9	EMPTY
PRESS ENTER for NO	10	EMPTY

If a Recall is requested from an empty buffer, the following message is displayed:

STORE/RECALL CONFIGURATIONS	#	Status
	1	DS3-MON (DS3)
Action: Recall	2	>EMPTY
	3	EMPTY
Test #: 2	4	EMPTY
	5	EMPTY
-----	6	EMPTY
Cannot recall from	7	EMPTY
an empty buffer.	8	EMPTY
Press ENTER to	9	EMPTY
continue.	10	EMPTY

When a Clear is executed, the selected buffer is cleared, and the status for that buffer is set to "EMPTY". Before clearing a non-empty buffer, the system prompts the user with the following message:

STORE/RECALL CONFIGURATIONS	#	Status
	1	>DS3-MON (DS3)
Action: Clear	2	EMPTY
	3	EMPTY
Test #: 1	4	EMPTY
03/13/93 16:59:38	5	EMPTY
-----	6	EMPTY
Clear the buffer?	7	EMPTY
	8	EMPTY
Press MENU for YES	9	EMPTY
Press ENTER for NO	10	EMPTY

Chapter 6: Measurements

This chapter defines the measurements available on the results screens of the various modes.

Results Screens

A major feature of the Series 31XE is the rich results display associated with each test. Results are dependent upon details of each test configuration. This chapter gives definitions for each of the test results and parameters.

Results for each of the test configurations are dependent upon two factors. The actual test mode determines which results screens will be calculated while the Results Level determines which of the screens are displayed. Results levels can be set from 1 to 4 with the higher number containing more detailed data than lower numbers. When results are printed out only the displayed results are printed. All results are stored whenever the Store pushbutton is depressed.

Each results parameter is described in detail below.

STS-1 Measurements

Section Code Violations (B1)

Sect CV Count: Section Code Violations: Incremented for each section BIP-8 error detected in the B1 byte (up to eight per frame).

Sec Ago: Section CV Seconds Ago: Elapsed time since last Section CV.

CV BER (avg): Section CV Bit Error Rate: The average bit error rate over the measurement interval, based on the Section BIP-8 (B1 byte). This will be a straight ratio of BIP-8 errors to number of section bits transmitted (including section and line overhead). Above a certain level this measurement will saturate.

CV BER (cur): Section CV Current Bit Error Rate: The Section bit error rate calculated over the preceding 2.25 seconds.

ES: Section Errored Seconds: A count of seconds in which at least one Section CV or OOF Event occurred.

SES: Section Severely Errored Seconds: A count of seconds during which at least 9 Section CVs (STS-1 receive rate) or one OOF Event occurred.

EFS: Section Error Free Seconds: A count of seconds in which neither a Section CV nor an OOF occurred.

%EFS: Section Percent Error Free Seconds: Section Error Free Seconds as a percentage of total measured seconds.

Line Code Violations (B2)

Line CV Count: Line Code Violations: Incremented for each line BIP-8 error detected in the B2 byte (up to 8 per frame for STS-1).

Sec Ago: Line CV Seconds Ago: Elapsed time since last Line CV.

CV BER (avg): Line CV Bit Error Rate: The average bit error rate over the measurement interval. This will be a straight ratio of BIP-8 errors to the number of line bits transmitted (excluding section overhead). This measurement will saturate above a certain level.

CV BER (cur): Line CV Current Bit Error Rate: The Line bit error rate calculated over the preceding 2.25 seconds.

ES: Line Errored Seconds: A count of seconds in which at least one Line CV occurred.

SES: Line Severely Errored Seconds: A count of seconds during which at least 12 Line CVs (STS-1 receive rate) occurred.

EFS: Line Error Free Seconds: A count of seconds in which no Line CVs occurred.

%EFS: Line Percent Error Free Seconds: Line Error Free Seconds as a percentage of total measured seconds.

STS Frame Measurements (A1/A2)

OOF Events: Out Of Frame Events: Counts once whenever an Out-Of-Frame condition is declared. (Out-Of-Frame is declared when four or more consecutive errored framing patterns have been received.)

%EFS: Frame Percent Error-Free Seconds: Frame EFS as a percentage of total measured seconds.

Severely Err Frm Sec: Severely Errored Framing Seconds: Count of seconds in which an OOF Event occurred.

EFS: Frame Error-Free Seconds: Count of seconds in which no OOF Event occurred.

STS-1 Signal Measurements

STS-1 Rx Hz: STS-1 Receive Frequency: The recovered clock frequency of the received STS-1 data pattern, measured in Hertz, appears in this field.

STS-1 Rx Pk V: STS-1 Receive Peak Voltage: The received signal level, measured in volts peak, (Vp) is shown. The accuracy of the measurement is 5%.

STS-1 dBdsx: STS-1 Receive dBdsx Level: The received signal level, measured in dB referenced to an STSX-1 signal (0 dBdsx = 0.53 volts peak) is displayed. The accuracy of the measurement is 1 dB.

STS-1 BPV Measurements

BPV Count: Bipolar Violation Error Count: The number of bipolar errors that have been detected during the measurement period is displayed in this field.

Sec Ago: Section CV Seconds Ago: Elapsed time since last Bipolar Violation.

BPV BER (avg): Average Bipolar Violation Bit Error Rate: The number of Bipolar Violation errors divided by the total number of bits transmitted during the entire test interval is displayed.

BPV BER (cur): Bipolar Violation Current Bit Error Rate: The number of Bipolar Violation errors divided by the total number of bits transmitted in the most recent 2.25 second interval is displayed.

LCVR Sec: Line Code Violation Rate Seconds: The number of seconds in LCVR state is displayed here. The LCVR state starts when the BPV count is greater than 44 for one second and continues until the BPV count is less than 4 for one second. These thresholds correspond to error rates of approximately $10E-6$ and $10E-7$, respectively.

ES: BPV Errored Seconds: The number of seconds during which at least one BPV has occurred.

EFS: BPV Error Free Seconds: The number of seconds during which no BPV has occurred is displayed.

%EFS: BPV Percent Error Free Seconds: The number of BPV error-free seconds as a percentage of total measured seconds is displayed in this field.

Path Code Violations (B3)

Path CV Count: Path Code Violations: Incremented for each path BIP-8 error detected in the B3 byte (up to 8 per frame).

Sec Ago: Path CV Seconds Ago: Elapsed time since last Path CV.

CV BER (avg): Path CV Bit Error Rate: The average bit error rate over the measurement interval. This will be a straight ratio of BIP-8 errors to number of path bits transmitted (excluding section and line overhead). This measurement will saturate above a certain level.

CV BER (cur): Current Path CV Bit Error Rate: The path bit error rate calculated over the most recent 2.25 seconds.

Path UAS: Path Unavailable Seconds: The path is declared unavailable after 10 consecutive Path SESs. It is declared available again after 10 consecutive seconds with no Path SES. The Path UAS count includes the initial 10 second period, but not the final 10 second period. The path is also unavailable during Path LOP or Path AIS.

ES: Path Errored Seconds: A count of seconds in which at least one Path CV occurred.

SES: Path Severely Errored Seconds: A count of seconds during which at least 9 Path CVs occurred.

- EFS: Path Error Free Seconds: A count of seconds in which no Path CVs occurred.
- %EFS: Path Percent Error Free Seconds: Path Error Free Seconds as a percentage of total measured seconds.

Path FEBE Measurements

- FEBE CV Count: Path Far End Block Errors: Counts the Far End Block Errors reported.
- Sec Ago: Path FEBE Seconds Ago: Elapsed time since last Path FEBE.
- CV BER (avg): Path FEBE Bit Error Rate: The average FEBE bit error rate over the measurement interval. This will be a straight ratio of BIP-8 errors to number of path bits transmitted (excluding section and line overhead). This measurement will saturate above a certain level.
- CV BER (cur): Current Path FEBE Bit Error Rate: The Path FEBE bit error rate calculated over the most recent 2.25 seconds.
- ES: Path FEBE Errored Seconds: A count of seconds in which at least one Path FEBE occurred.
- SES: Path FEBE Severely Errored Seconds: A count of seconds during which at least 9 Path FEBEs occurred.
- FEBE UAS: Path FEBE Unavailable Seconds: The (reverse) path is declared unavailable after 10 consecutive Path FEBE SESs. It is declared available again after 10 consecutive seconds with no Path FEBE SES. The Path FEBE UAS count includes the initial 10 second period, but not the final 10 second period.
- EFS: Path FEBE Error Free Seconds: A count of seconds in which no Path FEBEs occurred.
- %EFS: Path Percent Error Free Seconds: Path FEBE Error Free Seconds as a percentage of total measured seconds.

STS-1 Pointer Measurements

- Pointer Just: STS-1 Pointer Justifications: A count of the total number of positive and negative pointer adjustments which have occurred.

Last PJ Dir: STS-1 Last Pointer Justification Direction:
An indication (positive or negative) of the
direction of the last pointer justification.

LOPNTR Sec: Loss of Pointer Seconds: The number of seconds
during which a loss of pointer condition has been
declared.

Pointer Value: STS-1 (H1/H2) Pointer Value: The decimal
value of the STS-1 (H1/H2) pointer.

PJSec: Pointer Justification Seconds: A count of seconds
in which an STS-1 pointer adjustment has occurred.

NDFSec: New Data Flag Seconds: Bits 1 -4 of the pointer
word carry a New Data Flag which permits an
arbitrary change in the pointer value due to a
change in the payload. This field in the display
indicates the number of seconds during which a New
Data Flag has been initiated indicating a shift in
the alignment of the SPE.

EFS: STS-1 Pointer Error Free Seconds: The number of
seconds during which no invalid H1/H2 pointers
were received.

%EFS: STS-1 Pointer Percent Error Free Seconds: STS-1
Pointer EFS as a percentage of total measured
seconds.

APS (K1/K2) Measurements

State Chng Sec: APS State Change Seconds: The number of
seconds during which at least one change in
receive APS messages was detected.

Byte Fail Sec: APS Byte Failure Seconds: The number of
seconds during which at least one APS Byte Failure
condition was detected. An APS byte failure
condition is declared after 8 successive frames
which do not contain identical APS bytes in at
least 3 consecutive frames.

Request Chan: Requested Channel: The channel number (0-15)
to which the received condition message applies.
This code is received in bits 5-8 of the K1 byte.
Channel 0 is the Null Channel. Channel 15 is the
Extra Traffic Channel. Channels 1-14 are the
working channels.

APS State: APS State: Displays one of 12 valid or 4 unused condition messages indicated by bits 1 - 4 of the received K1 byte. Receipt of one of the unused condition messages is equivalent to an Invalid Code Failure. The 16 codes and their corresponding messages are as follows:

K1 Bit 1234	Message
0000	No Request
0001	Do Not Revert
0010	Reverse Request
0011	Not Used
0100	Exercise
0101	Not Used
0110	Wait-to-restore
0111	Not Used
1000	Manual Switch
1001	Not Used
1010	SD - Low Priority
1011	SD - High Priority
1100	SF - Low Priority
1101	SF - High Priority
1110	Forced Switch
1111	Lockout of Protection

Note: The corresponding message appears on the front panel display.

Type: APS Type: The APS Architecture Type at the far-end. Indicated as either 1+1 (K2 bit 5=0) or 1:n (K2 bit 5=1).

Mode: APS Mode: The switching mode at the far end, which is received on bits 6-8 of K2. Two of the possible 8 codes are valid, 4 are reserved for future use, and 2 are used for AIS and FERF indications. If either AIS or FERF is received, it will be displayed as the value for APS Mode. (As well as triggering the appropriate receive alarms.) The 8 APS codes which may be received are:

K2 Bit 678	Mode
000	Future
001	Future
010	Future
011	Future
100	Unidirectional Switching
101	Bidirectional Switching
110	Line FERF
111	Line AIS

Note: The corresponding mode appears on the front panel display.

Bridge Chan: Bridged Channel: The number of the channel (0-15) currently bridged onto the protection line at the far end. This code is received in bits 1-4 of the K2 byte. Channel 0 is the Null Channel. Channel 15 is the Extra Traffic Channel. Channels 1-14 are the working channels.

STS-1 Transport Overhead

- H1: This byte is the first half of the value used to indicate the offset from the beginning of the synchronous payload envelope.
- H2: This byte is the second half of the value used to indicate the offset from the beginning of the synchronous payload envelope.
- F1: This field displays the received Section User Channel value.
- K1, K2: These bytes are used for Automatic Protection Switch signals.

STS-1 Path Overhead

- C2: The C2 Path Signal Label identifies the STS payload mapping. Ten values have been assigned to identify construction and content of the SPE (Synchronous Payload Envelope). They are as follows:

<u>C2 (Hex)</u>	<u>SPE Content</u>
00	Unequipped
01	Equipped - Non Specific Payload
02	Floating VT Mode

03	Locked VT Mode
04	Asynchronous Mapping for DS3
05	Mapping for Byte Observable Syntran
12	Asynchronous Mapping for DS4NA
13	Mapping for ATM
14	Mapping for DQDB
15	Asynchronous Mapping for FDDI

F2: The F2 Path User Channel is displayed here.

H4: The H4 Indicator is used as an indicator for specific payload mappings. VT1.5 mappings use H4 to provide a repeating 0, 1, 2, 3 frame count that identifies the members of the VT superframe.

Z3, Z4, Z5: The three Growth Bytes.

O-Bit: When DS3 signals are mapped into an STS-1 payload, 18 bits are reserved as overhead, and are called O-bits.

STS-1 Path Trace Byte (J1)

The 64 byte path trace is formed from the J1 value in 64 consecutive STS-1 frames. The sequence is captured and displayed in both hexadecimal and ASCII formats. Display of the entire sequence requires two results screens.

STS Alarm Seconds

A count is maintained of seconds during which each of the following alarms is active. The alarm conditions are defined in Chapter 3.

LOS: Loss of Signal Seconds

LOF: Loss of Frame Seconds

LOPNTR: STS Loss of Pointer Seconds

PAIS: STS-1 Path AIS Seconds

PYEL: STS-1 Path Yellow

LAIS: Line Alarm Indication Seconds

LFERF: Line Far End Receive Failure

LOCLK: Loss of Clock Seconds

STS Alarm Hist

Alarm and history are displayed on a result screen for each of the alarm conditions indicated on front panel lights. Certain alarms for which there are no front panel lights are displayed only on the result screen. The alarms and their detection criteria are detailed in Chapter 3.

STS Status

Status conditions are displayed on a result screen for as well as on front panel lights. The status indicators and their detection criteria are detailed in Chapter 3.

VT1.5 Measurements

VT1.5 Code Violations (V5)

VT CV Count: VT1.5 Code Violations: Incremented for each VT BIP- 2 error detected in the V5 byte (up to 2 per frame).

Sec Ago: VT1.5 CV Seconds Ago: Elapsed time since last VT CV.

CV BER (avg): VT1.5 CV Bit Error Rate: The average bit error rate over the measurement interval. This will be a straight ratio of BIP-2 errors to number of VT1.5 bits transmitted. This measurement will saturate above a certain level.

CV BER (cur): Current VT1.5 CV Bit Error Rate: The bit error rate calculated over the most recent 2.25 seconds.

VT UAS: VT1.5 Unavailable Seconds: The VT is declared unavailable after 10 consecutive VT SESSs. It is declared available again after 10 consecutive seconds with no VT SES. The VT UAS count includes the initial 10 second period, but not the final 10 second period. The VT is also unavailable during VT LOP or VT PAIS.

ES: VT1.5 Errored Seconds: A count of seconds in which at least one VT1.5 CV occurred.

SES: VT1.5 Severely Errored Seconds: A count of seconds during which at least 4 VT1.5 CVs occurred.

EFS: VT1.5 Error Free Seconds: A count of seconds in which no VT1.5 CVs occurred.

%EFS: VT1.5 Percent Error Free Seconds: VT1.5 Error Free Seconds as a percentage of total measured seconds.

VT1.5 FEBE Measurements

FEBE CV Count: VT1.5 Far End Block Errors: Counts the Far End Block Errors reported.

Sec Ago: VT FEBE Seconds Ago: Elapsed time since last VT FEBE.

CV BER (avg): VT1.5 FEBE Bit Error Rate: The average FEBE bit error rate over the measurement interval. This will be a straight ratio of BIP-2 errors to the number of VT1.5 bits transmitted. This measurement will saturate above a certain level.

CV BER (cur): Current VT1.5 FEBE Bit Error Rate: The FEBE bit error rate calculated over the most recent 2.25 seconds.

FEBE UAS: VT1.5 FEBE Unavailable Seconds: The VT1.5 is declared unavailable after 10 consecutive VT1.5 FEBE SESSs. It is declared available again after 10 consecutive seconds with no VT1.5 FEBE SES. The VT1.5 FEBE UAS count includes the initial 10 second period, but not the final 10 second period.

ES: VT1.5 FEBE Errored Seconds: A count of seconds in which at least one VT1.5 FEBE occurred.

SES: VT1.5 FEBE Severely Errored Seconds: A count of seconds during which at least 4 VT1.5 FEBEs occurred.

EFS: VT1.5 Error Free Seconds: A count of seconds in which no VT1.5 CVs occurred.

%EFS: VT1.5 Percent Error Free Seconds: VT1.5 Error Free Seconds as a percentage of total measured seconds.

VT1.5 Pointer Measurements

LOPNTR Sec: Loss of Pointer Seconds: The number of seconds during which a loss of pointer condition has been declared.

Pointer Value: VT1.5 (V1/V2) Pointer Value: The decimal value of the VT1.5 (V1/V2) pointer.

V1, V2: V1, V2 Values: The hexadecimal values of V1 and V2.

- PJSec: VT1.5 Pointer Justification Seconds: A count of the number of seconds during which at least one positive or negative VT1.5 pointer justification has occurred.
- EFS: VT1.5 Pointer Error Free Seconds: The number of seconds during which no invalid V1/V2 pointers were received.
- %EFS: VT1.5 Pointer Percent Error Free Seconds: VT1.5 Pointer EFS as a percentage of total measured seconds.

VT1.5 Alarm

VT1.5 alarms are shown in individual fields of a results screen, as well as on front panel alarm lights. The definition of each alarm and its detection criteria is presented in Chapter 3.

- PAIS: Path Alarm Indication Signal
- PYEL: Path Yellow Alarm Indication
- LOPNTR: Loss of Pointer Condition

VT1.5 Alarm Seconds

The number of seconds that specific alarms are active is displayed on the screen. The definition of each alarm and its detection criteria is presented in Chapter 3.

- PAIS: Path Alarm Indication Signal
- PYEL: Path Yellow Alarm Indication
- LOPNTR: Loss of Pointer Condition

DS3 Measurements

DS3 Signal Measurements

- Drop Hz: DS3 Drop Frequency: The recovered clock frequency from a DS3 dropped from a SONET signal.data pattern.
- Rx Hz: Frequency Received: The recovered clock frequency from the received bipolar DS3 signal.

Rx Pk V: Received Signal Level, Peak Voltage: This field shows the peak voltage of the received signal. It is measured in volts with an accuracy of 5%.

Rx dBdsx: Received Signal Level Referenced to DSX-3: The display field indicates, in dB, a measure of the received signal level referenced to a DSX-3 signal. The accuracy of the measurement is 1dB.

DS3 Bit Error Measurements

Error Count: The number of bits that were transmitted at one level but received at another is displayed here.

Sec Ago: Seconds Ago: The elapsed time since the last bit error.

Average Ratio: The Average ratio is defined as the ratio of the number of bit errors to the total number of transmitted bits.

ES: Errored Seconds: Errored Seconds, a count of the number of seconds with bit rates greater than zero is displayed here.

Sync ES: Synchronous Errored Seconds: This is a count of the number of seconds with bit error counts greater than zero. The boundaries of the time scale are synchronized to the errors.

Sev ES: Severely Errored Seconds: A display of non-LOP seconds with bit error rates greater than $10E-3$ is presented. This value corresponds to 44,100 or more errors per second for framed modes and 44,700 or more errors per second in unframed mode.

EFS: Error Free Seconds: This is a measure of the number of seconds that have elapsed with no Loss Of Pattern or bit errors.

%EFS: Percentage of Error Free Seconds: The percentage of error free seconds is the ratio of error free seconds to the total elapsed seconds.

Avail Sec: Available Seconds: The number of available seconds is the difference between the total number of seconds in the measurement period and the seconds declared unavailable.

Unavail Sec: Unavailable Seconds: This is the number of seconds that occur after 10 consecutive severely errored or LOP seconds. Unavailable seconds remain in effect until 10 consecutive non-severely errored, non-LOP seconds have occurred.

Thrsh E-3 to Thrsh E-6: Four different Threshold Error Second counts are displayed. They indicate the number of available seconds in which the larger of either the bit error count or P-Bit parity error count equals or exceeds the threshold values shown below. Parity errors are not used in Loss of Frame Conditions.

Screen Display	Framed Mode	Unframed Mode
Thrsh E-3	44,100	44,700
Thrsh E-4	4,410	4,470
Thrsh E-5	441	447
Thrsh E-6	44	44

Dribble: Dribbling Error Seconds: These are the errors defined when an error rate of 10E-6 is not exceeded in one second. For a residual or dribbling error second to be declared, the number of errors must be between 1 and 43.

CSES3: Consecutive Severely Errored Seconds displays the number of severely errored seconds which have had the previous two seconds severely errored. The count is reset during LOS, LOF or LOP.

DS3 BPV Measurements

Count: Bipolar Violation Error Count: This field indicates the number of seconds of the test interval during which Bipolar Violation Errors have been detected.

Sec Ago: Seconds Ago: The elapsed time since the last BPV.

Cur Ratio: Current Ratio: The number displayed in this field is the ratio of the number of Bipolar Violation errors to the total number of transmitted bits in the most recent 2.25 second measurement interval.

Avg Ratio: Average Ratio: The average ratio is the ratio of the number of Bipolar Violation errors detected to the total number of bits transmitted during the elapsed test time.

LCVR Sec: Line Code Violation Rate Seconds: The number of seconds in LCVR state is displayed here. The LCVR state starts when the BPV count is greater than 44 for one second and continues until the BPV count is less than 4 for one second. These thresholds correspond to error rates of approximately $10E-6$ and $10E-7$, respectively.

ES: Errored Seconds: This field displays the number of seconds during which frames containing errors have been received.

EFS: Error-Free Seconds: This is the number of seconds during which error-free frames have been received.

%EFS: Percentage of Error-Free Seconds: This field displays the percentage of frame error-free seconds relative to the total number of seconds in the measurement period.

DS3 Section Parity Measurements (P-Bit)

Count: P-Bit Error Count: This displays a count of the number of P-Bit parity errors.

Sec Ago: Seconds Ago: The elapsed time since the last P-Bit error.

Avg Ratio: Average Ratio: The Average Ratio is the ratio of the number of P-Bit parity errors to the total number of bits transmitted during the elapsed test time.

Cur Ratio: Current Ratio: The number displayed in this field is the ratio of the number of P-bit parity errors to the total number of transmitted bits in the most recent 2.25 second measurement interval.

ES: Errored Seconds: This displays a count of the number of seconds with the P-Bit parity error count greater than zero.

EFS: Error Free Seconds: This is a measure of the number of seconds that have elapsed with no P-bit errors.

%EFS: Percentage of Error-Free Seconds: This is a ratio of the number of P-Bit parity error-free seconds to the total number of seconds in the measurement interval.

DS3 Path Parity Measurements (CP-Bit)

- Count:** CP-Bit Error Count: This is a count of the number of CP-Bit parity errors measured in C-Bit parity framing mode only. In other framing modes two dashes (- -) appear in this field.
- Sec Ago:** Seconds Ago: The elapsed time since the last CP-Bit error.
- Avg Ratio:** CP-Bit Average Ratio: The Average Ratio is the ratio of the number of CP-Bit parity errors to the total number of bits transmitted during the elapsed test time.
- Cur Ratio:** Current Ratio: The number displayed in this field is the ratio of the number of CP-bit parity errors to the total number of transmitted bits in the most recent 2.25 second measurement interval.
- ES:** Errored Seconds: This represents the number of seconds with CP-Bit parity counts greater than zero.
- EFS:** Error Free Seconds: This is a measure of the number of seconds that have elapsed with no CP-bit errors.
- %EFS:** Percentage of Error-Free Seconds: This is a ratio of the number of CP-Bit parity error-free seconds to the total number of seconds in the measurement interval.

DS3 Frame Measurements

- Count:** Framing Error Count: This field contains the count of F1 or F10 bits that are received in error.
- Sec Ago:** Seconds Ago: The elapsed time since the last framing error.
- ES:** Errored Seconds: This field displays the number of seconds during which frames containing errors have been received.
- Avg Ratio:** Average Ratio: The average ratio is the ratio of the number of frame bit errors detected to the total number of F-bits transmitted during the elapsed test time.

Cur Ratio: Current Ratio: The number displayed in this field is the ratio of the number of framing errors to the total number of transmitted F-bits in the most recent 2.25 second measurement interval.

EFS: Error-Free Seconds: This is the number of seconds during which error-free frames have been received.

%EFS: Percentage of Error-Free Seconds: This field displays the percentage of frame error-free seconds relative to the total number of seconds in the measurement period.

DS3 FFCV Measurements

NE Cnt: Near-End Error Count: When using M13 framing, this field contains the total number of frame-format coding errors (F- or M-bit errors within an M-frame) that have occurred. With C-bit framing, the field displays either: F- or M-bit errors that have occurred in an M-frame or CP-bit errors that have occurred in the following M-frame

FE Cnt: Far-End Error Count: For M-13 Framing format, this field is blank. For C-bit framing, this field contains the total number of errors that occur as a result of three Far-End Blocking Errors (FEBE) bits which are not all binary 1's.

NE ES A: Near-End Errored Seconds, Type A: This field displays the number of one second intervals with exactly one near-end FFCV and no near-end OOF or AIS events.

FE ES A: Far-End Errored Seconds, Type A: This field displays the number of one second intervals with exactly one far-end FFCV and no far-end OOF or AIS events.

NE ES B: Near-End Errored Seconds, Type B: This measurement is defined as the number of one second intervals with no less than 2 and no more than 44 near-end FFCVs with no near-end OOF or AIS events.

FE ES B: Far-End Errored Seconds, Type B: This measurement is defined as the number of one second intervals with no less than 2 and no more than 44 far-end FFCVs with no far-end OOF or AIS events.

NE ES C: Near-End Errored Seconds, Type C: This is a count of the number of one second intervals that have more than 44 near-end FFCV, OR and OOF or AIS events.

FE ES C: Far-End Errored Seconds, Type C: This is a count of the number of one second intervals that have more than 44 far-end FFCV, OR and OOF or AIS events.

DS3 Alarm and Status Seconds

A count is maintained of seconds during which each of the following alarm and status indicators are active. The alarm and status conditions are defined in Chapter 3.

AIS Sec: Alarm Indication Signal Seconds:

LOS Sec: Loss of Signal Seconds

Idle Sec: Idle Channel Signal Seconds

OOF Sec: Out of Frame Seconds

LOP Sec: Loss of Pattern Seconds

LCVA Sec: Line Code Violation Alarm Seconds

DS3 Alarm Hist

Alarm and history are displayed on the screen for each of the alarm conditions indicated on front panel lights. Certain alarms for which there are no front panel lights are displayed only on the result screen. The alarms and their detection criteria are detailed in Chapter 3.

DS3 Status

Status conditions are displayed on a screen as well as on front panel lights. The status indicators and their detection criteria are detailed in Chapter 3.

DS2 Alarms and Status

DS2 alarm and status conditions are defined in Chapter 3.

DS1 Measurements

DS1 Signal Measurements

Drop Hz: DS1 Drop Frequency: The frequency of the recovered clock of the dropped DS1 signal, in Hertz.

- Rx Hz: Received Frequency: The recovered clock frequency from the incoming bipolar DS3 signal.
- Rx Pk V: Received Signal Level, Peak Voltage: This field shows the peak voltage of the received signal. It is measured in volts with an accuracy of 5%.
- Rx dBdsx: Received Signal Level Referenced to DSX-1: The display field indicates, in dB, a measure of the received signal level referenced to a DSX-1 signal. The accuracy of the measurement is 1dB and the range is from -30 to +6 dB.
- EXZ: Excessive zeros: The test set detects and counts each occurrence of a zero string greater than 15 for AMI coding, or greater than 7 for B8ZS coding. Each contiguous zero string is considered to be one event.

DS1 Bit Error Measurements

Error Count: Error Count: The bit error count is defined as the total number of bits that have been transmitted from the source to the destination and have been received during the assigned time slot with bit values changed. The value is calculated over the measurement interval.

Sec Ago: The elapsed time since the last bit error.

Average Ratio: The average ratio is the ration of the number of bit errors to the total number of bits transmitted during the elapsed test time.

Current Ratio: The current ration is the ratio of the number of bit errors that occur in a 2.25 second interval to the total number of bits transmitted.

ES: Errored Seconds: A count of the number of seconds with at least one bit error.

Sev ES: Severely Errored Seconds: A display of non-LOP seconds with bit error rates greater than $10E-3$.

Sync ES: Synchronous Errored Seconds: This is a count of the number of seconds with bit error counts greater than zero. The boundaries of the time scale are synchronized to the errors.

EFS: Error Free Seconds: This is a measure of the number of seconds that have elapsed with no bit errors or loss of pattern.

- %EFS:** Percentage of Error Free Seconds: The percentage of error free seconds is the ratio of error free seconds to the total elapsed seconds.
- Avail Sec:** Available Seconds: The number of available seconds is the difference between the total number of seconds in the measurement period and the seconds declared unavailable.
- Unavail Sec:** Unavailable Seconds: This is the number of seconds that occur after 10 consecutive severely errored or LOP seconds. Unavailable seconds remain in effect until 10 consecutive non-severely errored, non-LOP seconds have occurred.
- Degrad Min:** Degraded Minutes: Degraded minutes are the number of 60 second intervals during which the Available Seconds and the bit error count is greater than zero but less than the SES threshold count or Available Seconds and the CRC error count is greater than zero but less than three-hundred twenty. The sixty second intervals need not be continuous.
- Thrsh E-3 to Thrsh E-6:** Four different Threshold Error Second counts indicate the number of available seconds in which the larger of either the bit error count or CRC error count equals or exceeds the threshold values shown below. CRC errors are not used in Loss of Frame Conditions. With ESF framing, the number of CRC errors will be counted under normal and Loss of Pattern Conditions.

Screen Display	Framed Mode	Unframed Mode
Thrsh E-3	1,536	1,544
Thrsh E-4	154	154
Thrsh E-5	15	15
Thrsh E-6	2	2

- Dribble:** Dribbling Error Seconds: Dribbling error seconds are declared for seconds with at least one error, but for which an error rate of 10E-6 is not exceeded. (The error count in one second must be between 1 and 14.)
- CSES3:** Consecutive Severely Errored Seconds displays the number of severely errored seconds which have had the previous two seconds severely errored. The count is reset during LOS, LOF or LOP.

DS1 CRC-6 Error Measurements

Count: Error Count: This field contains the count of ESF CRC-6 fields that are in error. This field will be displayed only when Extended Superframe framing is selected. In frame search mode, even with ESF selected, no CRC-6 errors will be calculated

Sec Ago: The elapsed time since the last recorded CRC error.

Avg Ratio: Average Ratio: The average ratio is the ratio of the number of CRC-6 errors to the number of bits that have been transmitted during the elapsed test interval.

Cur Ratio: Current Ratio: The current ratio is the ratio of the number of CRC-6 errors that occur in a 2.25 second interval to the total number of bits transmitted during the interval.

ES: Errored Seconds: This field displays the number of seconds that have CRC-6 errors.

EFS: Error-Free Seconds: This field displays the number of seconds during which there are no CRC-6 errors.

%EFS: Percent Error-Free Seconds: The number of CRC-6 error free seconds is expressed as a percentage of the total measurement interval seconds.

DS1 Frame Error Measurements

Count: Framing Error Count: This field contains the count of Ft or Fs bits (for Superframe framing), FPS bits (for Extended Superframe framing) and Ft bits (for SLC96 framing) that are received in error.

Sec Ago: The elapsed time since the last framing error.

Avg Ratio: Average Ratio: The average ratio is the ratio of the number of frame bit errors detected to the total number of frame bits transmitted during the elapsed test time.

Cur Ratio: Current Ratio: The current ratio is the ratio of the number of frame errors measured during a 2.25 second interval to the total number of frame bits transmitted during that period.

ES: Errored Seconds: This field displays the number of seconds during which frames containing framing errors have been received.

- EFS: Error-Free Seconds: This is the number of seconds during which error-free frames have been received.
- %EFS: Percentage of Error-Free Seconds: This field displays the percentage of framing error-free seconds relative to the total number of seconds in the measurement period.

DS1 Combined Frame & CRC Errors

- ES: Errored Seconds: This field displays the number of seconds during which at least one CRC-6 or framing error without an OOF indication has occurred.
- ES A: Errored Seconds, Type A: This field displays the number of seconds during the measurement interval during which a single CRC and no OOF condition has occurred.
- ES B: Errored Seconds, Type B: This field displays the number of seconds during which at least one but less than 320 CRC errors have occurred with no OOF condition.
- SES: Severely Errored Seconds: During the measurement interval, a second during which an OOF condition or 320 CRC errors occurs increments the count displayed in this field.
- Cons SES: Consecutive Severe Error Seconds: This field displays the number of seconds during which 10 consecutive seconds with combined Frame/CRC Severely Errored Seconds have occurred.

DS1 BPV Measurements

- Count: Error Count: This field displays the number of bipolar errors detected during the measurement period. A bipolar violation is declared when two successive pulses of the same polarity are detected, except when they are part of a B8ZS zero substitution code.
- Sec Ago: The elapsed time since the last BPV.
- Avg Ratio: Average Ratio: The average ratio is the number of bipolar errors to the total number of bits that have been received during the elapsed test time.

Cur Ratio: Current Ratio: The current ratio is the ratio of the number of bipolar errors to the total number of bits received during a 2.25 second interval.

LCVR Sec: Line Code Violation Rate Seconds: This field displays the number of seconds in the LCVR state. The LCVR state is entered when the BPV count exceeds 15 for one second and is exited when the BPV count drops to less than 1 per one second. (These values correspond to threshold rates of approximately $10E-6$ and $10E-7$, respectively.

ES: Errored Seconds: This field displays the number of seconds during the test interval in which BPV errors have been detected.

EFS: Error-Free Seconds: This field displays the number of seconds during the testing interval that contain no Bipolar Violation Errors.

%EFS: Percentage of Error-Free Seconds: This field displays the percentage of seconds in the test interval that have no Bipolar Violation Errors.

DS1 Slips

DS1 slips are measured by comparing the timing relationship between the received signal and an external reference signal. The reference signal, a DSX-1 bipolar source, is applied through the rear panel reference input connector. A frame slip is declared if a difference of 193 time slots is detected.

Bit Slips: Bit Slips Count: The number of bit slips in either direction. A negative value indicates that the Rx frequency is less than the reference frequency, and vice versa. If the reference is lost and reappears during the test, any prior count will be lost and the count will be reset to zero.

Frm Slips: Frame Slips Count: A frame slip is declared if a difference of 193 time slots is detected. One or more frame slips per .25 sec are counted as a single slip.

Slip Sec: Slip Seconds: The number of seconds in the test interval that had controlled framing slips is indicated in the display.

Rx Hz: Frequency of received DS1 signal.

Delta Hz: The received frequency minus the reference frequency.

DS1 Alarm Seconds

A count is maintained of seconds during which each of the following alarm indicators are is active. The alarm conditions are defined in Chapter 3.

LOS: Loss of Signal

LOP: Loss of Pattern

AIS: Alarm Indication Signal

Yellow: Yellow Alarm

OOF: Out of Frame

COFA: Change of Frame Alignment

DS1 Alarm & Hist

Alarm and history are displayed on the screen for each of the alarm conditions indicated on front panel lights. Certain alarms for which there are no front panel lights are displayed only on the result screen. The alarms and their detection criteria are detailed in Chapter 3.

DS1 Status

Status conditions are displayed on a screen as well as on front panel lights. The status indicators and their detection criteria are detailed in Chapter 3.

DS0 Measurements

Level: The RMS power in dBm (referenced to 1 mW at 600 ohms) of the dropped DS0 Voice Frequency signal.

>+3dBm Thres. Sec: A count of seconds during which the dropped DS0 Voice Frequency signal is greater than or equal to the 3 dBm clipping level.

Freq: The frequency of the dropped DS0 tone, in Hz.

Data: The eight bit binary value of the dropped DS0 channel.

- A: The value of the A signalling bit of the dropped DS0 channel.
- B: The value of the B signalling bit of the dropped DS0 channel.
- C: The value of the C signalling bit of the dropped DS0 channel.
- D: The value of the D signalling bit of the dropped DS0 channel.

E1 Measurements (Rx)

E1 Signal Measurements

- Drop Hz: E1 Drop Frequency: The frequency of the recovered clock of the dropped E1 signal, in Hertz.
- Rx Hz: Frequency Received: The recovered clock frequency from the incoming bipolar E1 signal.
- EXZ: Excessive zeros: The test set detects and counts each occurrence of a zero string greater than 15 for AMI coding, or greater than 4 for HDB3 coding. Each contiguous zero string is considered to be one event.

E1 Bit Error Measurements

- Bit: Bit Error Count: The bit error count is defined as the total number of bits that have been transmitted from the source to the destination and have been received during the assigned time slot with bit values changed. The value is calculated over the measurement interval and is displayed here.
- Average Ratio: The average ratio is the ratio of the number of bit errors to the total number of bits transmitted during the elapsed test time.
- Current Ratio: The current ratio is the bit error ratio calculated over the most recent 2.25 seconds.
- ES: Errored Seconds: A count of the number of seconds in which there was at least one bit error.
- Sev ES: Severely Errored Seconds: A display of non-LOP seconds with bit error rates greater than $10E-3$ is presented.

Sync ES: Synchronous Errored Seconds: This is a count of the number of seconds with bit error counts greater than zero. The boundaries of the time scale are synchronized to the errors.

EFS: Error Free Seconds: This is a measure of the number of seconds that have elapsed with no Loss Of Pattern or bit errors.

%EFS: Percentage of Error Free Seconds: The percentage of error free seconds is the ratio of error free seconds to the total elapsed seconds.

Avail Sec: Available Seconds: The number of available seconds is the difference between the total number of seconds in the measurement period and the seconds declared unavailable.

Unavail Sec: Unavailable Seconds: This is the number of seconds that occur after 10 consecutive severely errored or LOP seconds. Unavailable seconds remain in effect until 10 consecutive non-severely errored, non-LOP seconds have occurred.

Degrad Min: Degraded Minutes: Degraded minutes are the number of times 60 seconds are seen, each meeting the following conditions:

Available Second, and either:

0 < bit error count < bit SES threshold count

0 < CRC error count < 320

Thrsh E-3 to Thresh E-6: Threshold Error Seconds: This indicates the number of available seconds in which the bit error count equals or exceeds the bit error threshold, or the CRC error count equals or exceeds the CRC error threshold. Threshold values are shown below.

CRC errors are not used in Loss of Frame Conditions. With CRC-4 framing, the number of CRC errors will be counted under normal and Loss of Pattern Conditions.

<u>Screen Display</u>	<u>Bit Error Thresholds</u>			<u>CRC Error Threshold</u>
	<u>Unfrm</u>	<u>TS0</u>	<u>TS16</u>	
Thrsh E-3:	2,048	1,984	1,920	--
Thrsh E-4:	205	198	192	205
Thrsh E-5:	21	20	19	21
Thrsh E-6:	2	2	2	2

Dribble: Dribbling Error Seconds: Dribbling error seconds are declared for seconds with at least one error, but for which an error rate of $10E-6$ is not exceeded. (The error count in one second must be between 1 and 14.)

CSES3: Consecutive Severely Errored Seconds displays the number of severely errored seconds which have had the previous two seconds severely errored. The count is reset during LOS, LOF or LOP.

E1 TS0 Frame Error Measurements

Count: Framing Error Count: This field contains the count of TS0 Frame Word Errors. This count is valid for all framed E1 modes.

Avg Ratio: Average Ratio: The average ratio is the ratio of the number of frame word errors detected to the total number of frame words transmitted during the elapsed test time.

Cur Ratio: Current Ratio: The current ratio is the framing error ratio calculated over the most recent 2.25 seconds.

ES: Errored Seconds: This field displays the number of seconds during which frames containing TS0 frame word errors have been received.

EFS: Error-Free Seconds: This is the number of seconds during which error-free frames have been received.

%EFS: Percentage of Error-Free Seconds: This field displays the percentage of framing error-free seconds relative to the total number of seconds in the measurement period.

E1 CAS Frame Error Measurements

Count: Framing Error Count: This field contains the count of TS16 Column Associated signalling frame words. This count is valid only in TS16 framing modes.

Avg Ratio: Average Ratio: The average ratio is the ratio of the number of CAS frame word errors detected to the total number of frame words transmitted during the elapsed test time.

Cur Ratio: Current Ratio: The current ratio is the framing error ratio calculated over the most recent 2.25 seconds.

- ES: Errored Seconds: This field displays the number of seconds during which frames containing CAS frame word errors have been received.
- EFS: Error-Free Seconds: This is the number of seconds during which error-free frames have been received.
- %EFS: Percentage of Error-Free Seconds: This field displays the percentage of framing error-free seconds relative to the total number of seconds in the measurement period.

E1 CRC-4 Error Measurements

- Count: Error Count: This field contains the count of CRC-4 bits that are in error. This count is valid only for CRC-4 framed E1 modes.
- Avg Ratio: Average Ratio: The average ratio is the ratio of the number of CRC-4 errors over the number of bits that have been transmitted during the elapsed test interval.
- Cur Ratio: Current Ratio: The current ratio is the CRC-4 error ratio calculated over the most recent 2.25 seconds.
- ES: Error Seconds: This field displays the number of seconds that have CRC-4 errors.
- EFS: Error-Free Seconds: This field displays the number of seconds during which there are no CRC-4 errors.
- %EFS: Percent Error-Free Seconds: The number of CRC-4 error free seconds is expressed as a percentage of the total measurement interval seconds.

E1 BPV Measurements

- Count: Error Count: This field displays the number of bipolar errors detected during the measurement period. Except for zero substitution with HDB3, a bipolar violation is declared when two successive pulses of the same polarity occur.
- Avg Ratio: Average Ratio: The average ratio is the number of bipolar errors to the total number of bits that have been received during the elapsed test time.
- Cur Ratio: Current Ratio: The current ratio is the BPPV error ratio calculated over the most recent 2.25 seconds.

- LCVR Sec: Line Code Violation Rate Seconds: This field displays the number of seconds in the LCVR state. The LCVR state is entered when the BPV count exceeds 15 for one second and is exited when the BPV count drops to less than 1 per one second. (These values correspond to threshold rates of approximately $10E-6$ and $10E-7$, respectively.
- ES: Errored Seconds: This field displays the number of seconds that have occurred during the test interval with BPV errors.
- EFS: Error-Free Seconds: This field displays the number of seconds during the testing interval that contain no Bipolar Violation Errors.
- %EFS: Percentage of Error-Free Seconds: This field displays the percentage of seconds in the test interval that have no Bipolar Violation Errors.

E1 Slips

E1 slips are measured by comparing the timing relationship between the received signal and an external reference signal. (The reference signal, a DSX-1 bipolar source) is applied through the rear panel reference input connector. A frame slip is declared if a difference of 256 time slots is detected.

Bit Slips: Bit Slips Count: The number of bit slips in either direction. A negative value indicates that the Rx frequency is less than the reference frequency, and vice versa. If the reference is lost and reappears during the test, any prior count will be lost and the count will be reset to zero.

Frm Slips: Frame Slips Count: A frame slip is declared if a difference of 256 time slots is detected. One or more frame slips per .25 sec are counted as a single slip.

Slip Sec: Slip Seconds: The number of seconds in the test interval that had controlled framing slips is indicated in the display.

Rx Hz: Frequency of received DS1 signal.

Delta Hz: The received frequency minus the reference frequency.

E1 Alarm Seconds

A count is maintained of seconds during which each of the following alarm indicators are is active. The alarm conditions are defined in Chapter 3.

LOS: Loss of Signal

OOF: Out of Frame

LOP: Loss of Pattern

AIS: Alarm Indication Signal

Remote: Yellow Alarm, or Remote Alarm

Distant: Distant Multiframe Alarm

Ex O's: Excess Zeros Alarm

E1 Alarm & Hist

Alarm and history are displayed on the screen for each of the alarm conditions indicated on front panel lights. Certain alarms for which there are no front panel lights are displayed only on the result screen. The alarms and their detection criteria are detailed in Chapter 3.

E1 Status

Status conditions are displayed on the screen. The status indicators and their detection criteria are detailed in Chapter 3.

E1 Time Slot Measurements

Level: The RMS power in dBm (referenced to 1 mW at 600 ohms) of the dropped Voice Frequency signal.

>+3dBm Thres. Sec: A count of seconds during which the dropped Voice Frequency signal is greater than or equal to 3 dBm.

Freq: The frequency of the dropped VF tone, in Hz.

Data: The eight bit binary value of the dropped time slot.

- A: The value of the A signalling bit of the dropped time slot.
- B: The value of the B signalling bit of the dropped time slot.
- C: The value of the C signalling bit of the dropped time slot.
- D: The value of the D signalling bit of the dropped time slot.

Chapter 7: Specifications

STS-1 Interfaces

STS-1 Receive and Transmit Interfaces are provided on the front panel.

Front-Panel STS-1 Transmitter Specifications

STSX-1:	Per TR-TSY-000253 Typical 0.53V peak +/- 1.2 dB LBO: 450 ft simulated 728A cable
High:	Typical 1.11 V peak +/- 1.2 dB LBO: None
900:	Typical 0.35 V peak +/- .2 dB LBO: 900 ft simulated 728A cable
Low:	Typical .206 V peak 2 dB LBO: Flat loss from High Level
Line Code:	B3ZS
Impedance:	75 ohm 5%
Connector:	WECO 440 Compatible

Front-Panel STS-1 Receiver Specifications

STSX-1:	Automatic equalizer for 0 to 900 ft of 728A cable
STSX-1 MON:	Up to 26 dB flat loss relative to nominal STSX-1 level.
High:	Nominal 1.11 V peak input signal.
Low:	Nominal .206 V peak input signal.
Line Code:	B3ZS
Impedance:	75 ohm 5%
Connector:	WECO 440 Compatible

DS3 Interfaces

DS3 transmit, receive, and drop ports are provided on the front panel.

Front-Panel DS3 Transmitter Specifications

DSX3:	Per TR-TSY-000499 Typical 0.48V peak +/- 1.2 dB LBO: 450 ft simulated 728A cable
High:	Typical .91 V peak +/- 1.2 dB LBO: None
900:	Typical .33 V peak +/- 2 dB LBO: 900 ft simulated 728A cable
Low:	Typical .186 V peak +/- 2 dB LBO: Flat loss from High Level
Line Code:	B3ZS
Impedance:	75 ohms 5%
Connector:	WECO 440 Compatible

Front-Panel DS3 Drop Specifications

DSX3:	Per TR-TSY-000499 Typical 0.48V peak +/- 1.2 dB LBO: 450 ft simulated 728A cable
Line Code:	B3ZS
Impedance:	75 ohms 5%
Connector:	WECO 440 Compatible

Front-Panel DS3 Receiver Specifications

DSX3: Automatic equalizer
for 0 to 900 ft of 728A cable.

DSX3-MON: Up to 26 dB flat loss
relative to nominal DSX3 level.

High: Nominal .91 V peak input signal.

Low: Nominal .186 V peak input signal.

Line Code: B3ZS

Impedance: 75 ohms 5%

Connector: WECO 440 Compatible

DS1 Interfaces

Front-panel DS1 transmit, receive, and drop ports are provided. In addition, the front panel receive and transmit ports are bridged to a rear-panel DS1 Network Interface Connector. There is also an Auxiliary rear-panel DS1 receive port.

Front-Panel DS1 Transmitter Specifications

DSX1: Per TR-TSY-000499
Typical 3.0 V peak +/- 1 dB

LBO: Choice of 7.5, 15, and 22 dB cable
simulators, building out from DSX1
level.

Line Code: AMI, B8ZS

Impedance: 100 ohms 5%, balanced

Connector: WECO 310 Compatible

Front-Panel DS1 Drop Specifications

DSX1: Per TR-TSY-000499
Typical 3.0 V peak +/- 1 dB

Line Code: AMI, B8ZS

Impedance: 100 ohms 5%, balanced

Connector: WECO 310 Compatible

DS1 Receiver Specifications

DSX1: Per TR-TSY-000499
Typical 3.0 V peak input level
Equalized for 0 to 655 ft of 22 gauge
pulp insulated cable.

ALBO: Automatic equalizer for 400 to 4000 ft
of 22 gauge pulp insulated cable.

DSX-1 Mon: 10 to 25 dB flat loss relative to a
nominal DSX1 level.

Line Code: AMI, B8ZS

Impedance: 100 ohms 5% (Terminate) or 1000 ohms
(Bridge).

Connector: WECO 310 Compatible

Rear-Panel DS1 Network Interface Port

Connector: 15-pin D female (Parallel connection
to front panel DS1 receive and
transmit ports.)

Pin 1: DS1 Tx Tip
Pin 9: DS1 Tx Ring
Pin 3: DS1 Rx Tip
Pin 11: DS1 Rx Ring

E1 Interfaces

The front-panel DS1 transmit, receive, and drop connectors
double as E1 ports.

Front-Panel E1 Transmitter Specifications

Level: 3.0 V peak +/- 1 dB

Line Code: AMI, HDB3

Impedance: 120 ohms, balanced

Connector: WECO 310 Compatible

Front-Panel E1 Drop Specifications

Level: 3.0 V peak +/- 1 dB
Line Code: AMI, HDB3
Impedance: 120 ohms, balanced
Connector: WECO 310 Compatible

E1 Receiver Specifications

DSX: Typical 3.0 V peak input level
Monitor: Typical 0.3 V peak input level
Line Code: AMI, HDB3
Impedance: 120 ohms 5% (Terminate) or ≥ 1000 ohms (Bridge).
Connector: WECO 310 Compatible

DS0 and E1 Timeslot Interfaces

VF Input and Output

Level: -55 dBm to +3.0 dBm
0 dBm = 774.6 VRMS
Connector: WECO 310 Compatible

DS0 Drop & Data Link Port

Connector: DB25-S
Signal Levels: EIA RS-232C
Pin 2: Tx Data
Pin 24: Tx Clock
Pin 7: Ground

The port is programmed as either the 64 kb/s DS0 drop, or the 4kb/s ESF Facility Data Link (FDL).

Signaling Output Port

Connector: DB9-S

Signal Levels: TTL, 50 ohm

Pin 1: Signaling Bit A (dropped)

Pin 2: Signaling Bit B (dropped)

Pin 3: Signaling Bit C (dropped)

Pin 4: Signaling Bit D (dropped)

Pin 5: Ground

Control Interfaces

Burst Error In Specifications

Levels: TTL

Impedance: 50 ohms

Connector: BNC

DS3 and DS1 Bit Error Outputs

Levels: TTL

Impedance: 50 ohms

Connector: BNC

Printer Output Specifications

Format: RS-232C, with request-to-send & clear-to-send.

Connector: 25-pin D male

Pin 2: Rx Data Input

Pin 3: Tx Data Output

Pin 4: Request to Send (RTS) Input

Pin 5: Clear to Send (CTS) Output

Pin 7: Signal Ground

Pin 20: Data Terminal Ready (DTR)
(Tied to Pin 4).

Remote Control Port Specifications

Format: RS-232C, with request-to-send & clear-to-send.

Connector: 25-pin D female

Pin 2: Rx Data Input
Pin 3: Tx Data Output
Pin 4: Request to Send (RTS) Input
Pin 5: Clear to Send (CTS) Output
Pin 7: Signal Ground
Pin 6: Tie to pin 5 for modem applications

For applications using a video terminal or PC-COM port, a straight-through cable is suitable. For modem applications, a general purpose modem can be used, with user commands conforming to the popular "AT" command set, and the cross-over cable specified below.

The following commands should be programmed into the modem:

Command Description

ATS0=1 Set auto-answer.
AT&C1 Enable Carrier Detect output (pin 8).
AT&Y0 Use profile 0 on power up.
ATQ1 Disable responses. (There will be no "OK" response to any commands entered after this command.)
ATE0 Disable echo. (Commands entered after this will not be echoed.)
AT&W0 Store this as user profile 0. This stores the configuration in non-volatile memory. (This command must be typed in "blind" with no echo or response from the modem.)

The required cross-over cable has male 25-pin D style connectors on each end, and provides the following connections:

<u>End A:</u>		<u>End B:</u>
Pin 2	to	Pin 3
Pin 3	to	Pin 2
Pin 4	to	Pin 8
Pin 8	to	Pin 4
Pin 6	to	Pin 20
Pin 20	to	Pin 6
Pin 7	to	Pin 7 (Shield)

Note that the cable is symmetrical, so it doesn't matter which end is connected to the modem, and which end to the test set.

IEEE-488 Port Specifications

The IEEE-488 GPIB (General Purpose Interface Bus) Interface conforms to standard IEEE-488.1.

Timing and Synchronization

The Series 31XE can provide Internal, External, or Looped timing at DS1, DS3, and/or STS-1 rates. A DS1 Reference input is also provided for measurement of controlled DS1 slips. External STS-1 timing is provided via a 51.84 MHz clock input or optional 1.544 MHz BITS timing input.

STS-1 Timing

Internal:	51.84 Mb/s, +/- 20 ppm (Optional Stratum 3, 4.5 PPM clock available.)
External:	Rear panel 51.84 MHz Clock In, TTL levels, BNC connector.
BITS Input:	A 1.544 MHz, all-ones framed DS1 signal is expected, with DSX-1 levels, 310 connector.
BITS Output:	A 1.544 MHz all-ones SF framed DS1 signal, with 310 connector. Becomes unframed all-ones in loss of clock conditions. Signal can be derived from either the received or transmitted SONET timing.

DS3 Timing

Internal:	44.736 Mb/s, +/- 20 ppm
External:	TTL levels, 50 ohm, BNC connector

DS1 Timing

Internal: 1.544 MHz, +/- 20 ppm

External: TTL levels, 50 ohm, BNC connector

DS1 Slips Reference: DSX1, Per TR-TSY-000499
Typical 3.0 V peak input level
310 connector

E1 Timing

Internal: 2.048 MHz, +/- 20 ppm

External: TTL levels, 50 ohm, BNC connector
(Uses DS1 Clock In connector)

E1 Slips Reference: DSX1, Per TR-TSY-000499
Typical 3.0 V peak input level
310 connector
(Uses DS1 Reference Connector)

Power

AC Line: 115VAC, 10%, 50-60 Hz

Environmental

Operating: 0 to 45C (32 to 113F)

Storage: -20 to +70C (-4 to 158F)

Mechanical

Size: 7.5" H x 14.5" W x 16" D

Weight: 25 lbs

Chapter 8: Options

The Series 31XE can be configured for desired interface rates from DS0 to STS-1 including E1. In addition, a number of options are available to enhance the operation of the test set.

Remote Front Panel Option

When installed, the Remote Front Panel Option uses a rear panel-mounted RS-232 serial port to **provide remote access** via a terminal or a PC terminal emulator.

Before using the remote control option, the serial port baud rate, start bits, and stop bits can be selected using the Administrative Setup configuration screen described in Chapter 5. The option allows the user to perform any Series 31XE function from a remote location. Any menu configuration and any front panel control pushbutton can be accessed from the remote control screen.

Numeric keys are used to simulate front panel pushbuttons. Indicators on the display simulate alarm, alarm history and status LEDs.

IEEE-488 / Command Line Interface

With this option, a rear-panel IEEE-488 GPIB (General Purpose Interface Bus) interfaces is provided. The GPIB provides a means for building automated test programs under computer control.

The Series 31XE adheres to the SCPI.1992 (Standard Commands for Programmable Instruments), as well as to the IEEE-488.1 and IEEE-488.2 standards.

Complete information on the IEEE Instrument Bus option can be found in the Series 31XE IEEE-488 Programming Guide.

To facilitate automatic testing in applications where an IEEE-488 interface is not available, the command line interface option can also be accessed via the RS-232 port.

Data/Event Logging Option

The Data/Event Logging Option monitors error and alarm conditions. Using a variety of user-selectable criteria, this option captures and displays report messages in an

event log. Report messages include the time and date. Up to fifty of these messages are stored and can be displayed to give the user a profile or history of events. The event messages can also be directed to the printer port.

Events are defined as the occurrence or clearing of alarm conditions or the occurrence of selected errors. Selectable errors include bit, framing, CRC/Parity, and bipolar violations for DS1, DS3 or STS-1 signals.

Operation of the Data/Event Logging option is described in Chapter 5.

Answer-Only Modem

An accessory to the Remote Interface, the Answer-Only Modem answers telephone calls to put the Series 31XE on-line. This option enhances remote operation by making it possible to dial in to a remote test site. It is then possible to review test results, change testing modes or alter any of the operating parameters of the test being run.

Rack Mount Kit

Although the Series 31XE is designed for portable use, certain applications require the instrument to become a permanent part of a test setup. In these applications, the rack mount option allows the Series 31XE to be mounted in a 19 or 23 inch standard instrumentation rack. This arrangement is useful for long term monitor or manufacturing test environments.

APPENDIX A: Software Download Procedure

Overview

The operating software for the Series 31XE can be upgraded without opening the case, or making any internal modifications to the unit. This is accomplished by download from an MS-DOS compatible PC via an RS-232 serial link. This link may be a direct cable connection from the PC to the Series 31XE or a modem link. Transmission rates are selectable from 1200 baud to 38.4 Kbaud.

Quick Procedure

- 1: Connect a straight-through RS-232 cable from the REMOTE RS-232 port on the rear panel of the model 156 to the COM1 port of the PC. (Do not use a null-modem cable.) If the PC has a 9-pin COM1 connector, use a standard 9-to-25 pin PC adapter.
- 2: Turn on the Series 31XE while depressing the MENU key. Hold the MENU key until a message is displayed on the Series 31XE LCD screen.
- 3: Place the download diskette in Drive A (or Drive B) of the PC.
- 4: Type A: (or B:) followed by <enter> on the PC to select the drive.
- 5: Type DOWNLOAD <enter> on the PC.
- 6: Press the START key on the Series 31XE to prepare the test set for software download.
- 7: Type <enter> on the PC to start the download.
- 8: After completion of the download, the Series 31XE LCD screen will indicate that download has been successfully completed. At this time, turn off and then restore the Series 31XE power. The test set will automatically execute a COLD-START procedure, restoring factory default settings to all parameters. The Series 31XE is now ready for operation.

Using a Different COM Port or Baud Rate

The quick procedure uses the default baud rates on both the download program and the test set. It is possible to change both the the Series 31XE and the PC COM port baud rates is a different rate is desired.

To select a different baud rate on the Series 31XE, use the VALUE keys on the test set to change the Baud Rate displayed on the LCD screen. This should be done immediately after STEP 2, above.

By adding parameters to the command entered in step 5 above, a different COM port or baud rate can be selected for the PC. The format for the command including these parameters is as follows:

```
DOWNLOAD /P# /B#### <enter>
```

/P# is /P1, /P2, /P3, or /P4 to specify COM1, COM2, COM3, or COM4. When no Port is specified, COM1 is used.

/B#### is /B1200, /B2400, /B4800, /B9600, /B19.2, or /B38.4 for Baud rate. When no Baud rate is specified, 38.4 Kbaud is used.

For example, to specify port COM2 at 9600 Baud, the command in step 5 would be:

```
DOWNLOAD /P2 /B9600 <enter>
```

Specialized Applications

For specialized applications involving non-standard COM3 or COM4 ports, additional parameters as shown below may also be used:

```
DOWNLOAD /P# /I# /B#### /A### <enter>
```

/P and /B are as defined above.

/I# is /I1, /I2, /I3, /I4, /I5, /I6 or /I7 which specifies the Interrupt Request Line (IRQ) for the selected COM port. If /I# is not specified, the value 4 is used for COM1 and COM3, and the value 3 is used for COM2 and COM4.

/A### is /A followed by 3 hexadecimal digits which identify the port base address for the selected COM port. If /A### is not specified, base addresses 3F8,

2F8, 3E8, and 2E8 are used for ports COM1 to COM4, respectively.

Distribution Diskette

Software is distributed on an MS-DOS compatible floppy diskette in one of the following formats, as specified by the user:

5 1/4", 1.2 MByte
3 1/2", 1.44M

Note: If you have only low-density disk drives on your PC, please contact the factory for special procedures.

The disk contains two files. One file is a PC-executable file called DOWNLOAD.EXE. The second file contains the Series 31XE operating software to be downloaded. The name of this file will vary depending on software version, but will always have the extension .OUT. When the DOWNLOAD program executes, it automatically downloads the first file in the working directory which has the .OUT extension.

This automatic feature can be over-ridden by typing a specific file name as part of the download command, for example:

```
DOWNLOAD  FILENAME.EXT  /P2  <enter>
```

In the quick procedure, no filename is specified, since there is only one .OUT file on the diskette.

The .OUT file is keyed specifically to individual Series 31XE serial numbers. A particular copy of the .OUT file may be valid for one or several Series 31XE serial numbers, depending on each user's requirements.

Appendix B: Warranty and Service

Warranty

The Series 31XE SONET Enhanced Transmission Test Set is warranted by CERJAC against defects in material and workmanship for three (3) years after shipment to the customer. The three (3) year warranty period applies only to the original purchaser and is not transferrable without the express written permission of CERJAC. At CERJAC's option, the equipment will be repaired or replaced at no charge during the warranty period. Liability under this warranty extends only to the replacement value of this equipment. This warranty will be considered void if the equipment has been altered without CERJAC's authorization or operated/installed in a manner inconsistent with CERJAC instructions, literature or operating manuals. No other warranty is expressed or implied. CERJAC is not liable for consequential damage.

In case of Technical Difficulty

If the Series 31XE appears not to be operating correctly, carefully check all setup configurations. Improper selection of timing modes or drop channels, for example, can result in improper operation. One way to check this is to perform a COLD-START operation, as described in Chapter 3 of this manual. To perform a COLD-START, turn the Series 31XE power on while holding the STOP button. Continue holding the STOP button until you see the message "Performing Cold Start".

The COLD-START returns all the settings to factory default values. Simple loopback tests can then be performed in Terminal Testing Modes such as DS3-DS3 (DS3) to check the operation of the test set. If this procedure does not solve the problem, CERJAC Customer Service (508-263-2004) should be consulted regarding the particular application, and to determine whether the set should be returned for repair.

If the set is to be returned, the Customer Service representative will assign a Return Merchandise Authorization (RMA) number. The equipment can then be shipped to:

Repair Department
CERJAC, Inc
43 Nagog Park
Acton, MA 01720

The RMA number should be marked on the outside of the shipping container. The following information should be included with the shipment:

1. Model #
2. Serial #
3. Contact name and phone number
4. Description of problem
5. Return "Ship to" address
6. Invoice address
7. Purchase order number (If unit is out of warranty)

MP MASTER



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